Gulf Cooperation Council

EDICT OF GOVERNMENT

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GSO 211 (1994) (English): INDUSTRIAL SAFETYAND HEALTH REGULATIONS PART 4 – HAZARDOUS MATERIALS SECTION 4.5 – CARCINOGENS

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INDUSTRIAL SAFETY AND HEALTH REGULATIONS
PART 4 – HAZARDOUS MATERIALS - CARCINOGENS

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INDUSTRIAL SAFETYAND HEALTH REGULATIONS
PART 4 – HAZARDOUS MATERIALS
– CARCINOGENS

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INTRODUCTION

This standard forms a part of the Gulf Arabian Industrial Safety and Health Regulations. It is complementary to the other parts, of which a complete list can be found in GSO 1580 "Industrial Safety and Health Regulations, Part 1, List of Contents" which can be obtained from the Gulf Arabian Standards Organization.

INDUSTRIAL SAFETYAND HEALTH REGULATIONS
PART 4 – HAZARDOUS MATERIALS – CARCINOGENS

SCOPE

This standard is concerned with Industrial Safety and Health Regulations, Part 4 - Hazardous Materials - Carcinogens.

1 Carcinogens

1.1 Miscellaneous Compounds

1.1 Definitions

— Absolute Filter. A filter capable of retaining 99.97 percent of a mono disperse aerosol of 0.3 micrometer particles.

— Authorized Employee. An employee who has been specifically assigned by the employer to work in the regulated area.

— Clean Change Room. A room where employees put on clean clothing and/or protective equipment in an environment free of the compound. The clean change room shall be contiguous to and have an entry from a shower room, when the shower room facilities are required elsewhere in this section.

— Closed System. An operation involving the compound where containment prevents its release into regulated areas, non-regulated areas, or the external environment.

— Decontamination. Inactivation of the compound or its safe disposal.

— Disposal. Safe removal of the compound from the work environment.

— Emergency. Unforeseen circumstance or set of circumstances resulting in the release of the compound which may result in exposure to or contact with it.

— External Environment. Areas not under control of the employer and external to regulated and non-regulated areas.

— Isolated System. Fully enclosed structure other than the vessel of containment of the compound which is impervious to the passage of the compound and which would prevent its entry into regulated areas, non-regulated areas, or the external environment, should leakage or spillage from the vessel of containment occur.

— Laboratory Type Hood. A shielding device enclosed on three sides and the top and bottom, designed and maintained so as to draw air inward at an average linear face velocity of 46 m/min. with a minimum of 38 m/min.; designed, constructed, and maintained in such a way that an operation involving the compound within the hocd does not require the insertion of any portion of any employee's body other than his hands and arms.

— Non-regulated Area. Area under the control of the employer where entry and exit is neither restricted nor controlled.

— Open Vessel System. Operation involving the compound in an open vessel, which is not in an isolated system, a laboratory type hood, nor in any other system affording equivalent protection against the entry of the compound into regulated areas, non-regulated areas, or the external environment.

— Regulated Area. Area where entry and exit is restricted and controlled.

1.2 Scope. This subparagraph applies to any area in which the compounds:

4-Nitrobiphenyl	alpha-Naphthylamine
Methyl chloromethyl ether	Benzidine
3,3' Dichlorobenzidine	4-Aminodiphenyl
bis-Chloromethyl ether	Ethyleneimine
beta-Naphthylamine	beta-Propiolactone
2-Acetylaminofluorene	4-Dimethylaminoazobenzene N-Nitrosodimethylamine

are manufactured, processed, repackaged, released, handled, or stored, but shall not apply to transshipment in sealed containers, except for the labeling requirements under subparagraphs 1.5.2, 1.5.3 and 1.5.4. The requirements of this subparagraph shall not apply under the following conditions:

1.2.1 4-Nitrobiphenyl. The requirements and standards shall not apply to solid or liquid mixtures containing less than 0.1 percent by weight or volume.

1.2.2 Methyl Chloromethyl Ether. The requirements and standards shall not apply to solid or liquid mixtures containing less than 0.1 percent by weight or volume.

1.2.3 3,3' Dichlorobenzidine (and its Salts). The requirements and standards shall not apply to solid or liquid mixtures containing less than 1.0 percent by weight or volume.

1.2.4 bis-Chloromethyl Ether. The requirements and standards shall not apply to solid or liquid mixtures containing less than 0. 1 percent by weight or volume.

1.2.5 beta-Naphthylamine. The requirements and standards shall not apply to solid or liquid mixtures containing less than 0.1 percent by weight or volume.

The requirements and standards shall not apply to operations involving the destructive distillation of carbonaceous materials, such as occurs in coke ovens.

1.2.6 Benzidine. The requirements and standards shall not apply to solid or liquid mixtures containing less than 0.1 percent by weight or volume.

1.2.7 4-Aminodiphenyl. The requirements and standards shall not apply to solid or liquid mixtures containing less than 0.1 percent by weight or volume.

1.2.8 Ethyleneimine. The requirements and standards shall not apply to solid or liquid mixtures containing less than 1.0 percent by weight or volume.

1.2.9 beta-Propiolactone. The requirements and standards shall not apply to solid or liquid mixtures containing less than 1.0 percent by weight or volume.

1.2.10 2-Acetylaminofluorene. The requirements and standards shall not apply to solid or liquid mixtures containing less than 1.0 percent by weight or volume.

1.2.11 alpha-Naphthylamine. The requirements and standards shall not apply to solid or liquid mixtures containing less than 1.0 percent by weight or volume.

1.2.12 4-Dimethylaminoazobenzene. The requirements and standards shall not apply to solid or liquid mixture containing less than 1.0 percent by weight or volume.

1.2.13 N-Nitrosodimethlyamine. The requirements and standards shall not apply to solid or liquid mixtures containing less than 1.0 percent by weight or volume.

The requirements and standards will not apply to operations involving the destructive distillation of carbonaceous materials such as occurs in coke ovens.

1.3 A regulated area shall be established by an employer where the compound is manufactured, processed, used, repackaged, released, handled or stored. All such areas shall be controlled in accordance with the requirements for the following categories of operations involved:

1.3.1 Employees working with the compound within an isolated system, such as a "glove box" shall wash their hands and arms upon completion of the assigned task and before engaging in other activities not associated with the isolated system.

1.3.2 In regulated areas where the compound is stored in sealed containers, or contained in a closed system, including piping systems, with any sample ports or openings closed while the compound is contained within, employees shall be required to wash hands, forearms, face and neck upon each exit from the regulated areas, close to the point of exit and before engaging in other activities.

1.3.3 Open vessel system operations as defined in subparagraph 1.1 are prohibited.

1.3.4 The provisions of this subparagraph shall apply in operations involving "laboratory type hoods," or in locations where the compound is contained in an otherwise "closed system," but is transferred, charged, or discharged into other normally closed containers.

1.3.4.1 Access shall be restricted to authorized employees only.

1.3.4.2 Each operation shall be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation. Exhaust air shall not be discharged to regulated areas, non-regulated areas or the external environment unless decontaminated. Clean makeup air shall be introduced in sufficient volume to maintain safe working conditions.

1.3.4.3 Employees shall be provided with, and required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirts and pants), shoe covers and gloves prior to entering the regulated area.

1.3.4.4 Employees engaged in handling operations shall be provided with and required to wear and use a half-face, filter-type respirator for dusts, mists, and fumes, in accordance with Section 5.3. A respirator affording higher levels of protection may be substituted.

1.3.4.5 Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit

of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal.

1.3.4.6 Employees shall be required to shower after the last exit of the day.

1.3.4.7 Drinking fountains are prohibited in the regulated area.

1.3.5 In cleanup of leaks or spills, maintenance or repair operations on contaminated systems or equipment, or any operations involving work in an area where direct contact with the compound could result, each authorized employee entering that area shall:

1.3.5.1 Be provided with and required to wear clean, impervious garments, including gloves, boots and continuous-air supplied hood in accordance with Section 5.3.

1.3.5.2 Be decontaminated before removing the protective garments and hood.

1.3.5.3 Be required to shower upon removing the protective garments and hood.

1.4 General Regulated Area Requirements

1.4.1 In an emergency, immediate measures including, but not limited to, the requirements of following subparagraphs shall be implemented.

1.4.1.1 The potentially affected area shall be evacuated as soon as the emergency has been determined.

1.4.1.2 Hazardous conditions created by the emergency shall be eliminated and the potentially affected area shall be decontaminated prior to the resumption of normal operations.

1.4.1.3 Special medical surveillance by a physician shall be instituted within 24 hours for employees present in the potentially affected area at the time of the emergency. A report of the medical surveillance and any treatment shall be included in the incident report, in accordance with subparagraph 1.6.2.

1.4.1.4 Where an employee has been in contact with a compound, such employee shall be required to shower as soon as possible, unless prevented by physical injuries.

1.4.1.5 An incident report on the emergency shall be made as provided in subparagraph 1.6.2.

1.4.2 Hygiene Facilities and Practices

1.4.2.1 Storage or consumption of food, storage or use of containers of beverages, storage or application of cosmetics, smoking, storage of smoking materials, tobacco products or other products for chewing, or the chewing of such products, are prohibited in regulated areas.

1.4.2.2 Where employees wear protective clothing and equipment, clean change rooms shall be provided in accordance with Section 2.6 for the number of such employees required to change clothes.

1.4.2.3 Toilets in regulated areas, shall be in a separate room.

1.4.3 Contamination Control

1.4.3.1 Regulated areas, except for outdoor systems, shall be maintained under negative pressure with respect to non-regulated areas. Clean make-up air in equal volume shall replace air removed.

1.4.3.2 Any equipment, materials, or other item taken into or removed from a regulated area shall be done in a manner that does not cause contamination in non-regulated areas or the external environment.

1.4.3.3 Decontamination procedures shall be established and implemented to remove the compound from surfaces of materials, equipment and the decontamination facility.

1.4.3.4 Dry sweeping and dry mopping are prohibited.

1.5 Signs and Training

1.5.1 Appropriate signs and instruction shall be posted at the entrance to, and exit from, regulated areas, informing employees of the procedures that must be followed in entering and leaving a regulated area.

1.5.1.1 Entrances to regulated areas shall be posted with signs bearing the Legend: CANCERSUSPECT AGENT, AUTHORIZED PERSONNEL ONLY.

1.5.1.2 Entrances to regulated areas where maintenance of decontamination activities are being done shall be posted with signs bearing the legend:

CANCER-SUSPECT AGENT EXPOSED IN THIS AREA
IMPERVIOUS SUIT INCLUDING GLOVES, BOOTS, AND
AIR-SUPPLIED HOOD REQUIRED AT ALL TIMES
AUTHORIZED PERSONNEL ONLY.

1.5.2 Container Contents Identification

1.5.2.1 Containers of the compound and containers containing contaminated clothing and equipment which are accessible only to, and handled only by, authorized employees, or by other employees trained in accordance with subparagraph 1.5.5, may have contents identification limited to an generic or proprietary name, of the carcinogen and percent concentration.

1.5.2.2 Containers of the compound and containers handled by employees other than authorized employees or employees trained in accordance with subparagraph 1.5.5 shall have contents identification which includes the full chemical name.

1.5.2.3 All containers shall have the warning words “CANCER-SUSPECT AGENT” displayed immediately under or adjacent to the contents identification.

1.5.2.4 Containers of the compound having corrosive or irritating properties shall have label statements warning of such hazards, noting particularly sensitive or affected portions of the body.

1.5.3 Lettering on signs and instructions required shall be a minimum letter height of 5 cm. Lettering on labels on containers required under this section shall not be less than ½ the size of the largest lettering on the package.

1.5.4 No statement shall appear on or near any required sign, label, or instruction which contradicts or detracts from the effect of any required warning, information or instruction.

1.5.5 Training and Indoctrination

1.5.5.1 Each employee prior to being authorized to enter a regulated area, shall receive a training and indoctrination program including, but not necessarily limited to:

1.5.5.1.1 The nature of the carcinogenic hazards of the compound, including local and systemic toxicity;

1.5.5.1.2 The specific nature of the operation involving the compound which could result in exposure;

1.5.5.1.3 The purpose for and application of the medical surveillance program, including, as appropriate, methods of self-examination;

1.5.5.1.4 The purpose for and application of decontamination practices and purposes;

1.5.5.1.5 The purpose for and significance of emergency practices and procedures;

1.5.5.1.6 The employee's specific role in emergency procedures;

1.5.5.1.7 Specific information to aid the employee in recognition and evaluation of conditions and situations which may result in the release of the compound;

1.5.5.1.8 The purpose for and application of specific first aid procedures and practices;

1.5.5.1.9 A review of this section at the employee's first training and indoctrination program and annually thereafter.

1.5.5.2 Specific emergency procedures shall be prescribed, and posted, and employees shall be familiarized with their terms, and rehearsed in the application.

1.6 **Reports**

1.6.1 Operations. The information required in following subparagraphs shall be reported in writing to the concerned authorities. Any changes in such information shall be similarity reported in writing within 15 calendar days of such change.

1.6.1.1 A brief description and in-plant location of the area(s) regulated and the address of each regulated area.

1.6.1.2 The name(s) and other identifying information as to the presence of the compound in each regulated area.

1.6.1.3 The number of employees in each regulated area, during normal operations including maintenance activities.

1.6.1.4 The manner in which the compound is present in each regulated area; for example, whether it is manufactured, processed, used, repackaged, released, stored, or otherwise handled.

1.6.2 Incidents. Incidents which result in the release of the compound into any area where employees may be potentially exposed shall be reported in accordance with this subparagraph.

1.6.2.1 A report of the occurence of the incident and the facts obtainable at that time including a report of any medical treatment of affected employees shall be made within 24 hours to the concerned authorities.

1.6.2.2 A written report shall be filed with the concerned authorities and shall include:

1.6.2.2.1 A specification of the amount of material released, the amount of time involved, and an explanation of the procedure used in determining this figure.

1.6.2.2.2 A description of the area involved, and the extent of known and possible employee exposure and area contamination.

1.6.2.2.3 A report of any medical treatment of affected employees, and any medical treatment of affected employees, and any medical surveillance program implemented.

1.6.2.2.4 An analysis of the circumstances of the incident, and measures taken or to be taken, with specific completion dates, to avoid further similar releases.

1.7 Medical Surveillance. At no cost to the employee, a program of medical surveillance shall be established and implemented for employees considered for assignment to enter regulated areas, and for authorized employees.

1.7.1 Examinations

1.7.1.1 Before an employee is assigned to enter a regulated area, a preassignment physical examination by a physician shall be provided. The examination shall include the personal history of the employee, family and occupational background, including genetic and environmental factors.

1.7.1.2 Authorized employees shall be provided periodic physical examinations, not less often than annually, following the preassignment examination.

1.7.1.3 In all physical examinations, the examining physician shall consider whether there exist conditions of increased risk, including reduced immunological competence, treatment with steroids or cytotoxic agents, and cigarette smoking.

1.7.2 Records

1.7.2.1 Employers of employees examined shall cause to be maintained complete and accurate records of all such medical examinations. Records shall be maintained for the duration of the employee's employment. Upon termination of the employee's employment, including retirement or death, or in the event that the employer ceases business without a successor, records, or notarized true copies thereof, shall be forwarded to the concerned authorities.

1.7.2.2 Records required by this subparagraph shall be provided upon request to authorized representatives of the concerned authorities and upon request of an employee or former employee, to a physician designated by the employee or to a new employer.

1.7.2.3 Any physician who conducts a medical examination shall furnish to the employer a statement of the employee's suitability for employment in the specific exposure.

2 Asbestos, Amosite, Actinolite, Anthophyllite, Chrysolite, Crocidolite and Tremolite

2.1 Definitions

— Asbestos. For the purpose of this paragraph, asbestos includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.

— Asbestos Fibers. Fibers longer than 5 micrometers.

2.2 Permissible Exposure to Airborne Concentrations of Asbestos Fibers

2.2.1 The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed two asbestos fibers/cu cm of air, as determined by the method prescribed in subparagraph 2.5.

2.2.2 No employee shall be exposed at any time to airborne concentrations of asbestos fibers in excess of 10 fibers/cu cm of air.

2.3 Methods of Compliance

2.3.1 Engineering Methods

2.3.1.1 Engineering controls, such as, but not limited to, isolation, enclosure, exhaust ventilation, and dust collection, shall be used to meet the exposure limits prescribed in subparagraph 2.2.

2.3.1.2 Local exhaust ventilation and dust collection systems shall be designed, constructed, installed, and maintained in accordance with good engineering practice.

2.3.1.3 All hand-operated and power-operated tools which may produce or release asbestos fibers in excess of the exposure limits prescribed in subparagraph 2.2., such as, but not limited to, saws, scorers, abrasive wheels, and drills, shall be provided with a local area or tool exhaust ventilation system.

2.3.2 Work Practices

2.3.2.1 Insofar as practicable, asbestos shall be handled, mixed, applied, removed, cut, scored, or otherwise worked in a wet state sufficient to prevent the emission of airborne fibers in excess of the exposure limits, unless the usefulness of the product would be diminished.

2.3.2.2 No asbestos cement, mortar, coating, grout, plaster, or similar material containing asbestos shall be removed from bags, cartons, or other containers in which they are shipped, without being either wetted, or enclosed, or ventilated so as to prevent effectively the release of airborne asbestos fibers in excess of the limits prescribed in subparagraph 2.2.

2.3.2.3 Employees engaged in the spraying of asbestos, the removal, or demolition of pipes, structures, or equipment covered or insulated with asbestos, and in the removal or demolition of asbestos insulation or coverings shall be provide with respiratory equipment in accordance with subparagraph 2.4.2.3 and with special clothing in accordance with subparagraph 2.4.3.

2.4 Personal Protective Equipment

2.4.1 Compliance with the exposure limits prescribed by subparagraph 2.2 may not be achieved by the use of respirators or shift rotation of employees, except:

2.4.1.1 During the time period necessary to install the engineering controls and to institute the work practices required by subparagraph 2.3.

2.4.1.2 In work situations in which the methods prescribed in subparagraph 2.3 are either technically not feasible or feasible to an extent insufficient to reduce the airborne concentrations of asbestos fibers below the limits prescribed by subparagraph 2.2.

2.4.1.3 In emergencies.

2.4.1.4 Where both respirators and personnel rotation are allowed by above subparagraphs and both are practicable, personnel rotation shall be preferred and used.

2.4.2 Where a respirator is permitted by subparagraph 2.4.1, it shall be used in accordance with Section 5.3 and the following paragraphs.

2.4.2.1 A reusable or single use air purifying respirator, or a respirator described in subparagraphs 2.4.2.2 or 2.4.2.3, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits when the ceiling or the eight hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed no more than 10 times those limits.

2.4.2.2 A full facepiece powered air purifying respirator, or a powered air purifying respirator, o a respirator described in subparagraph 2.4.2.3, shall be used to reduce th concentrations of airborne asbestos fibers in the respirator below the exposure limits when the ceiling or the eight hour time-weighted average concentrations of asbestos fiber are reasonably expected to exceed 10 times, but not 100 times, those limits.

2.4.2.3 A continuous flow or pressure-demand, supplied-air respirator shall be used to reduce th concentrations of airborne asbestos fibers in the respirator below the exposure limits, when the ceiling or the eight-hour time-weighted average airborne concentrations o asbestos fibers are reasonably expected to exceed 100 times those limits.

2.4.2.4 The employer shall establish a respirator program in accordance with Section 5.3.

2.4.2.5 No employee shall be assigned to tasks requiring the use of respirators if, based upon his most recent examination, an examining physican determines that the employee will be unable to function normally wearing a respirator, or that the safety or health of the employee or other employees will be impaired by his use of a respirator. Such employee shall be rotated to another job or given the opportunity to transfer to a different position whose duties he is able to perform with the same employer and in the same geographical area, if such a position is available.

2.4.3 The employer shall provide, and require the use of, special clothing, such as coveralls or similar whole body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos fibers, which exceed the ceiling level.

2.4.4 Change Rooms

2.4.4.1 At any fixed place of employment exposed to airborne concentrations of asbestos fibers in excess of the exposure limits, the employer shall provide change rooms for employees working regularly at the place.

2.4.4.2 The employer shall provide two separate lockers or containers for each employee, so separated or isolated as to prevent contamination of the employee's street clothes from his work clothes.

2.4.5 Laundering

2.4.5.1 Laundering of asbestos contaminated clothing shall be done so as to prevent the release of airborne asbestos fibers in excess of the exposure limits.

2.4.5.2 Any employer who gives asbestos-contaminated clothing to another person for laundering shall inform such person of the requirement in subparagraph 2.4.5.1 to effectively prevent the release of airborne asbestos fibers in excess of the exposure limits.

2.4.5.3 Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and labeled in accordance with subparagraph 1.5.2.

2.5 Monitoring

2.5.1 Every employer shall cause every place of employment where asbestos fibers are released to be monitored in such a way as to determine whether every employee's exposure to asbestos fibers is below the limits. If the limits are exceeded, the employer shall immediately undertake a compliance program in accordance with subparagraph 2.3.

2.5.2 Samples shall be collected from within the breathing zone of the employees, on membrane filters of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the eight hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

2.5.3 After the initial determinations required by subparagraph, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of employees. In no case shall the sampling be done at intervals greater than six months for employees whose exposure to asbestos may reasonably be foreseen to exceed the limits.

2.5.4 Samples shall be collected from areas of a work environment which are representative of the airborne concentrations of asbestos fibers which may reach the breathing zone of employees.

2.5.5 After the initial determinations required by subparagraph 2.5.3. 1, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of the employees. In no case shall sampling be at intervals greater than six months for employees whose exposures to asbestos may reasonable be foreseen to exceed the exposure Emits.

2.5.6 Affected employees, or their representatives shall be given a reasonable opportunity to observe any monitoring required by this paragraph and shall have access to the records thereof.

2.6 Caution Signs and Labels

2.6.1 Caution signs shall be provided and displayed at each location where airborne concentration of asbestos fibers may be in excess of the exposure limits. Signs shall be posted at such a distance from such a location so that an employee may read the signs and take necessary protective steps before entering the area marked by the signs. Signs shall be posted at all approaches to areas containing excessive concentrations of airborne asbestos fibers.

2.6.2 The warning signs required above shall conform to the requirements of 50 cm x 35 cm vertical format signs specified in Section 3.4 and to this subparagraph. The signs shall display the following legend in the lower panel, with letter sizes and styles of a visibility at least equal to that specified in this subdivision.

Legend	**Height**
Asbestos	25 mm
Dust hazard	20 mm
Avoid breathing dust	6 mm
Wear assigned protective equipment	6 mm
Do not remain in area unless your work requires it	6 mm
Breathing asbestos dust may be hazardous to your health	6 mm

Spacing between lines shall be at least equal to the height of the upper fine of any two lines.

2.6.3 Caution labels shall be affixed to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, or to their containers, except that no label is required where asbestos fibers have been modified by a bonding agent, coating, binder, or other material so that during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos fibers in excess of the exposure limits will be released.

2.6.4 The caution labels required shall be printed in letters of sufficient size and contrast as to be readily visible and legible. The label shall state:

CAUTION

CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
BREATHING ASBESTOS DUST MAY CAUSE
SERIOUS BODILY HARM

2.7 Housekeeping

2.7.1 All external surfaces in any place of employment shall be maintained free of accumulations of asbestos fibers if, with their dispersion, there would be an excessive concentration.

2.7.2 Asbestos waste, scrap, debris, bags, containers, equipment, and asbestos-contaminated clothing, consigned for disposal, which may produce in any reasonably foreseeable use, handling, storage, processing, disposal, or transportation airborne concentrations of asbestos fibers in excess of the exposure limits shall be collected and disposed of in sealed impermeable bags, or other closed, impermeable containers.

2.8 Record keeping

2.8.1 Every employer shall maintain records of any personal or environmental monitoring required by this section. Records shall be maintained for a period of at least 20 years and shall be made available upon request to the concerned authorities.

2.8.2 Every employee and former employee shall have reasonable access to any record required to be maintained which indicates the employee's own exposure to asbestos fibers.

2.8.3 Any employee found to have been exposed at any time to airborne concentrations of asbestos fibers in excess of the limits prescribed in subparagraph 2.2 shall be notified in writing of the exposure as soon as practicable but not later than five days of the finding. The employee shall also be timely notified of the corrective action being taken.

2.9 Medical Examination

2.9.1 The employer shall provide or make available at his cost, medical examinations relative to exposure to asbestos.

2.9.2 The employer shall provide or make available to each of his employees, within 30 calendar days following his first employment in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination, which shall include, as a minimum, a chest roentagenogram (posterior-anterior 35 x 43 cm), a history to elicit symptomatology of respiratory disease, and pulmonary function test to include forced vital capacity (FVC) and forced expiratory volume at one second (FEV 0).

2.9.3 At least annually every employer shall provide, or make available, comprehensive medical examinations to each of his employees engaged in occupations exposed to airborne concentrations of asbestos fibers. Such annual examination shall include, as a m, minimum a chest roentgenogram (posterior-anterior 35 x 43 cm), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at one second (FEV 0).

2.9.4 The employer shall provide, or make available, within 30 calendar days before or after the termination of employment of any employee engaged in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination which shall include, as a minimum, a chest roentgenogram (posterior-anterior 35 x 43 cm), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at one second (FEV 0).

2.9.5 No medical examination is required of any employee, if adequate records show that the employee has been examined in accordance with this subparagraph within the past one year period.

2.9.6 Employers of employees examined pursuant to this subparagraph shall cause to be maintained complete and accurate records of all such medical examinations. Records shall be retained by employers for at least 20 years.

2.9.7 The contents of the records of the medical examinations required by this subparagraph shall be made available, for inspection and copying, to the concerned authorities upon request of an employee or former employee, to his physician. Any physician who conducts a medical examination required by this subparagraph shall furnish to the employer of the examined employee all the information specifically required by this subparagraph, and any other medical information related to occupational exposure to asbestos fibers.

3 Vinyl Chloride

3.1 Definitions

— Action Level. Concentration of vinyl chloride of 0.5 ppm averaged over an eight hour work day.

— Authorized Person. Any person specifically authorized by the employer whose duties require him to enter a regulated area or any person entering such an area as a designated representative of employees for the purpose of exercising an opportunity to observe monitoring and measuring procedures.

— Emergency. Any occurrence such as, but not limited to, equipment failure, or operation of a relief device which is likely to, or does, result in massive release of vinyl chloride.

— Fabricated Product. Product made wholly or partly from polyvinyl chloride, and which does not require further processing at temperatures, and for times, sufficient to cause mass melting of the polyvinyl chloride resulting in the release of vinyl chloride.

— Hazardous Operation. Any operation, procedure, or activity where a release of either vinyl chloride liquid or gas might be expected as a consequence of the operation or because of an accident in the operation, which would result in an employee exposure in excess of the permissible exposure limit.

— Polyvinyl Chloride means polyvinyl chloride homopolymer or copolymer before such is converted to a fabricated product.

— Vinyl Chloride means vinyl chloride monomer.

3.2 Scope

3.2.1 This section includes requirements for the control of employee exposure to vinyl chloride (chloroethene).

3.2.2 This section applies to the manufacture, reaction, packaging, repackaging, storage, handling transportation or use of vinyl chloride or polyvinyl chloride, but does not apply to the handling or use of fabricated products made of polyvinyl chloride.

3.3 Permissible Exposure Limit

3.3.1 No employee may be exposed to vinyl chloride at concentrations greater than 1 ppm averaged over any eight hour period.

3.3.2 No employee may be exposed to vinyl chloride at concentrations greater than 5 ppm averaged over any period not exceeding 15 minutes.

3.3.3 No employee may be exposed to vinyl chloride by direct contact with liquid vinyl chloride.

3.4 Monitoring

3.4.1 A program of initial monitoring and measurement shall be undertaken in each establishment to determine if there is any employee exposed, without regard to the use of respirators, in excess of the action level.

3.4.2 Monitoring Program. Where a determination conducted under above subparagraph 3.4.1 shows any employee exposures, without regard to the use of respirators, in excess of the action level, a program for determining exposures for each such employee shall be established. Such a program:

3.4.2.1 Shall be repeated at least monthly where any employee is exposed, without regard to the use of respirators, in excess of the permissible exposure limit.

3.4.2.2 Shall be repeated not less than quarterly where any employee is exposed, without regard to the use of respirators, in excess of the action level.

3.4.2.3 May be discontinued for any employee only when at least two consecutive monitoring determinations, made not less than five working days apart, show exposures for that employee at or below the action level.

3.4.3 Whenever there has been a production, process or control change which may result in an increase in the release of vinyl chloride, or the employer has any other reason to suspect that any employee may be exposed in excess of the action level, a determination of employee exposure under subparagraph 3.4.1 shall be performed.

3.4.4 The method of monitoring and measurement shall have an accuracy (with a confidence level of 95 percent) of not less than ± 50 percent from 0.25 through 0.5 ppm, ± 35 percent from over 0.5 ppm through 1.0 ppm.

3.4.5 Employees or their designated representatives shall be afforded reasonable opportunity to observe the monitoring and measuring required.

3.5 Regulated Area

3.5.1 A regulated area shall be established where:

3.5.1.1 Vinyl chloride or polyvinyl chloride is manufactured, reacted, repackaged, stored, handled, or used.

3.5.1.2 Vinyl chloride concentrations are in excess of the permissible exposure limit.

3.5.2 Access to regulated areas shall be limited to authorized persons.

3.6 Methods of Compliance

3.6.1 Employee exposures to vinyl chloride shall be controlled at or below the permissible exposure limit provided in subparagraph 3.3 by engineering, work practice, and personal protective controls.

3.6.2 Wherever feasible engineering and work practice controls which can be instituted immediately are not sufficient to reduce exposure to at or below the permissible exposure limit, they shall nonetheless be used to reduce exposures to the lowest practicable level, and shall be supplemented by respiratory protection in accordance with subparagraph 3.7. A program shall be established and implemented to reduce exposures to at or below the permissible exposure limit, or to the greatest extent feasible, solely by means of engineering and work practice controls, as soon as feasible.

3.6.3 Written plans for such a program shall be developed and furnished upon request for examination and copping to authorized representative of the concerned authorities. Such plans shall be updated every six months.

3.6.2 Wherever feasible engineering and work practice controls which can be instituted immediately are not sufficient to reduce exposures to or below the permissible exposure limit, they shall nonetheless be used to reduce exposures to the lowest practicable level, and shall be supplemented by respiratory protection in accordance with subparagraph 3.7. A program shall be established and implemented to reduce exposures to or below the permissible exposure limit, or to the greatest extent feasible, solely by means of engineering and work practice controls, as soon as feasible.

3.6.3 Written plans for such a program shall be developed and furnished upon request for examination and copying to authorized representative of the concerned authorities. Such plans shall be updated every six months.

3.7 Respiratory Protection. Where respiratory protection is required under this subparagraph:

3.7.1 The employer shall provide a respirator which meets the requirements of this subparagraph and shall assure that the employee uses such respirator.

3.7.2 A respiratory protection program meeting the requirements of section 5.3 shall be established and maintained.

3.7.3 Selection of respirators for vinyl chloride shall be as follows:

Atmospheric Concentration of Vinyl Chloride	**Required Apparatus**
Unknown, or above 3,600 ppm	Open-circuit, self-contained breathing apparatus, pressure demand type, with full facepiece.
Not over 3,600 ppm	Supplied air respirator, pressure demand type, with full or half facepiece, and auxiliary selfcontained air supply, or Supplied air respirator continuous flow type, with full or half face-piece and auxiliary self-contained air supply.

Not over 1,000 ppm	Supplied air respirator continuous flow type, with full or half face-piece, helmet or hood.
Not over 100 ppm	Supplied air respirator demand type, with full facepiece, and auxiliary self-contained air supply, or Open-circuit self-contained breathing apparatus with full facepiece, in demand mode, or Supplied air respirator, demand type, with full facepiece.
Not over 25 ppm	A powered air-purifying respirator with hood, helmet, full or half facepiece, and a canister which provides a service life of at least four hours for concentrations of vinyl chloride up to 25 ppm, or Gas mask, front- or back-mounted canister which provides a service life of at least four hours for concentrations of vinyl chloride up to 25 ppm.
Not over 10 ppm	Supplied-air respirator, demand type, with half facepiece, and auxiliary self-contained air supply, or Supplied-air respirator, demand type, with half facepiece, or Any chemical cartridge respirator with an organic vapor cartridge which provides a service life of at least one hour for concentrations of vinyl chloride up to 10 ppm.

3.7.4 Air-purifying canisters or cartridges shall be replaced prior to the expiration of their service life or the end of the shift in which they are first used, whichever occurs first.

3.7.5 A continuous monitoring and alarm system shall be provided where concentrations of vinyl chloride could reasonably exceed the allowable concentrations for the devices in use. Such system shall be used to alert employees when vinyl chloride concentrations exceed the allowable concentrations for the devices in use.

3.7.6 Apparatus prescribed for higher concentrations may be used for any lower concentration.

3.8 Hazardous operations.

3.8.1 Employees engaged in hazardous operations, including entry of vessels to clean polyvinyl chloride residue from vessel walls, shall be provided and required to wear and use;

3.8.1.1 Respiratory protection in accordance with subparagraphs 3.3 and 3.7.

3.8.1.2 Protective garments to prevent skin contact with liquid vinyl chloride or with polyvinyl chloride residue from vessel walls. The protective garments shall be selected for the operation and its possible exposure conditions.

3.8.2 Protective garments shall be provided clean and dry for each use.

3.9 Emergency Situations. A written operational plan for emergency situations shall be developed for each facility storing, handling, or otherwise using vinyl chloride as a liquid or compressed gas. Appropriate portions of the plan shall be implemented in the event of an emergency. The plan shall specifically provide that:

3.9.1 Employees engaged in hazardous operations or correcting situations of existing hazardous releases shall be equipped as required in subparagraph 3.8.

3.9.2 Other employees not so equipped shall evacuate the area and not return until conditions are controlled by the methods required in subparagraph 3.6 and the emergency is abated.

3.9.3 Entry into unknown concentrations or concentrations greater than 36,000 ppm (lower explosive limit) may be made only for purposes of life rescue.

3.9.4 Entry into concentrations of less than 36,000 ppm, but greater than 3,6000 ppm may be made only for purposes of life rescue, fire-fighting, or securing equipment so as to prevent a greater hazard from release of vinyl chloride.

3.10 Training. Each employee engaged in vinyl chloride or polyvinyl chloride operations shall be provided training in a program relating to the hazards of vinyl chloride and precautions for its safe use. The program shall include:

3.10.1 The nature of the health hazard from chronic exposure to vinyl chloride including specifically the carcinogenic hazard.

3.10.2 The specific nature of operations which could result in exposure to vinyl chloride in excess of the permissible limit and necessary protective steps.

3.10.3 The purpose for, proper use, and limitations of respiratory protective devices.

3.10.4 The fire hazard and acute toxicity of vinyl chloride, and the necessary protective steps.

3.10.5 The purpose for and a description of the monitoring program.

3.10.6 The purpose for, and a description of, the medical surveillance program.

3.10.7 Emergency procedures.

3.10.8 Specific information to aid the employee in recognition of conditions which may result in the release of vinyl chloride.

3.10.9 A review of this standard at the employee's first training and indoctrination program, and annually thereafter.

3.11 Medical Surveillance

3.11.1 A program of medical surveillance shall be instituted for each employee exposed, without regard to the use of respirators, to vinyl chloride in excess of the action level. The program shall provide each such employee with an opportunity for examinations and tests in accordance with this subparagraph. All medical

examinations and procedures shall be performed by or under the supervision of a licensed physician, and shall be provided without cost to the employee.

3.11.2 At the time of initial assignment, or upon institution of medical surveillance a general physical examination shall be performed, with specific attention to detecting enlargement of liver, spleen or kidneys, or dysfunction in these organs, and for abnormalities in skin, connective tissues and the pulmonary system.

3.11.2.1 A medical history shall be taken. including the following topics:

— Alcohol intake;

— Past history of hepatitis;

— Work history and past exposure to potential hepatotoxic agents, including drugs and chemicals;

— Past history of blood transfusion and

— Past history of hospitalizations.

3.11.2.2 A serum specimen shall be obtained and determinations made

— Total bilirubin;

— Alkaline phosphatase;

— Serum glutamic oxalacetic transaminase (SGOT);

— Serum glutamic pyruvic transaminase (SGPT); and

— Gamma glustamyl transpeptidase.

3.11.3 Examinations provided in accordance with this subparagraph shall be performed at least: Every six months for each employee who has been employed in vinyl chloride or polyvinyl chloride manufacturing for 10 years or longer, and annually for all other employees.

3.11.4 Each employee exposed to an emergency shall be afforded appropriate medical surveillance.

3.11.4.1 A statement of each employee's suitability for continued exposure to vinyl chloride including use of protective equipment and respirators, shall be obtained from the examining physician promptly after any examination. A copy of the physician's statement shall be provided each employee.

3.11.4.2 If any employee's health would be materially impaired by continued exposure, such employee shall be withdrawn from possible contact with vinyl chloride.

3.11.4.3 Laboratory analyses for all biological specimens included in medical examinations shall be performed in licensed laboratories.

3.11.4.4 If the examining physician determines that alternative medical examinations to those required by subparagraph 3.11 will provide at least equal assurance of detecting medical conditions pertinent to the exposure to vinyl chloride, the employer may accept such alternative examinations as meeting the requirements of subparagraph 3.11.2 if the employer obtains a statement from the examining physician setting forth the alternative examinations and the rationale for substitution. This statement shall be available upon request for

examination and copying to authorized representatives of the concerned authorities,

3.12 Signs and Labels

3.12.1 Entrances to regulated areas shall be posted with legible signs bearing the legend:

CANCER-SUSPECT AGENT AREA
AUTHORIZED PERSONNEL ONLY

3.12.2 Areas containing hazardous operations or where an emergency currently exists shall be posted with legible signs bearing the legend:

CANCER-SUSPECT AGENT IN THIS AREA
PROTECTIVE EQUIPMENT REQUIRED
AUTHORIZED PERSONNEL ONLY

3.12.3 Container of polyvinyl chloride resin waste from reactors or other waste contaminated with vinyl chloride shall be legibly labeled:

CONTAMINATED WITH
VINYL CHLORIDE
CANCER-SUSPECT AGENT

3.12.4 Containers of polyvinyl chloride shall be legibly labeled:

POLYVINYL CHLORIDE (OR TRADE NAME)
CONTAINS VINYL CHLORIDE

VINYL CHLORIDE IS A
CANCER-SUSPECT AGENT

3.12.5 Containers of vinyl chloride shall be legibly labeled:

VINYL CHLORIDE

EXTREMELY FLAMMABLE GAS
UNDER PRESSURE
CANCER-SUSPECT AGENT

3.12.6 No statement shall appear on or near any required sign, label or instruction which contradicts or detracts from the effect of, any required warning, information or instruction.

3.13 Records

3.13.1 All records maintained in accordance with this section shall include the name and number of each employee where relevant and shall be made and shall be available upon request for examination and coppying to authorized representatives of the concerned authorities.

3.13.2 Monitoring and measuring records shall-

3.13.2.1 State the date of such monitoring and measuring and the concentrations determined and identify the instruments and methods used;

3.13.2.2 Include any additional information necessary to determine individual employee exposures where such exposures as determined by means other than individual monitoring of employees; and

3.13.3 Monitoring and necessary records shall be maintained for not less than 30 years.

3.13.4 Authorized personnel rosters shall be maintained for not less than 30 years.

3.13.5 Medical records shall be maintained for the duration of the employment of each employee plus 20 years, or 30 years, whichever is longer.

3.13.6 In the event that the employer ceases to do business and there is no successor to receive and retain his records for the prescribed period, these records shall be transmitted to the concerned authorities, and each employee individually notified in writing of this transfer.

3.13.7 Employees or their designated representatives shall be provided access to examine and copy records of required monitoring and measuring.

3.13.8 Former employees shall be provided access to examine and copy required monitoring and measuring records reflecting their own exposures.

3.13.9 Upon written request of any employee, a copy of the medical record of that employee shall be furnished to any physician designated by the employee.

3.14 Reports

3.14.1 Not later than one month after the establishment of a regulated area the following information shall be reported to the concerned authorities. Any changes to such information shall be reported within 15 days.

The address and location of each establishment which has one or more regulated area; and

The number of employees in each regulated area during normal operations, including maintenance.

3.14.2 The facts obtainable at that time, shall be reported within 24 hours to the concerned authorities. Upon request of the concerned authorities, the employer shall submit additional information in writing relevant to the nature and extent of employee exposures and measures taken to prevent future emergencies of similar nature.

3.14.3 Within ten working days following any monitoring and measuring which discloses that any employee has been exposed, without regard to the use of respirators, in excess of the permissible exposure limit, each such employee shall be notified in

writing of the results of the exposure measurement and the steps being taken to reduce the exposure to within the permissible exposure limit.

Appendix A

Vinyl Chloride Substance Information Sheet

Substance Identification

A. Substances. Vinyl chloride and polyvinyl chloride.

B. Definition. Vinyl chloride (CH_2CHCl) and polyvinyl chloride except to the fabricated products made of polyvinyl chloride.

C. Permissible exposure limits. 1 PPM as determined as an average over an 8 hour period. 5 PPM averaged over any period not exceeding 15 minutes. No employee may be exposed to direct contact.

D. Regulated area. Only employees authorized by his employer should enter a regulated area.

2. Health Hazard Data

A. Comments. The health hazard is high.

B. Ways in which the chemicals affects your body. Exposure to airborne concentrations of vinyl chloride may cause cancer of the lover and is a skin irritant. Contact causes skin burns by rapid evaporation and consequent freezing. It acts as a general anesthetic and may be fatal.

3. Protective Clothing and Equipment

A. Respirators. Respirators will be provided by employer at no cost for routine use if employer is in the process of implementing engineering and work practice controls or where engineering and work practice controls are not feasible or insufficient. Respirators must be worn for nonroutine activities or in emergency situations where exposure to levels of vinyl worn for nonroutine activities or in emergency situations where exposure to levels of vinyl chloride in excess of the permissible exposure limit. Respirator fit to the face is very important. Employer is required to conduct fit tests to make sure the respirator seals properly when worn. These tests are simple and rapid and will be explained during training sessions.

B. Protective clothing. If employee works in a regulated area, employer is required to provide at no cost to employee and employee must wear appropriate, clean, dry, protective clothing and equipment. Clothing, shoes, bandages or other articles by which vinyl chloride might be held in contact with the skin should be immediately removed to decrease the freezing effect.

C. Clothing should such items as coveralls, or similar full-body clothing, gloves, shoes or coverlets, and aprons. Protective equipment shall include face shields or vented goggles, where eye irritation may occur.

4. Hygiene Facilities and Practices

Do not take used protective clothing out of change rooms without employer's permission. Employer is required to provide for laundering or cleaning of protective clothing.

5. Signs and Labels

A. Employer is required to post warning signs and labels for employee protection. Signs must be posted in regulated areas. The signs must warns that a cancer hazard is present, that only authorized employees may enter the area, and that no smoking is allowed.

B. Container of vinyl chloride, vinyl chloride wastes or polyvinyl chloride wastes shall be legibly labeled.

6. Medical Examination

A. If exposure to vinyl chloride is over the action level (0.5 ppm, irregardless of respirators) each employee is provided a medical examination by the employer. The examination shall be every 6 months for employees in vinyl chloride or polyvinyl chloride manufacturing for 10 years or longer, and annually for all other employees.

B. The examining physician will provide a written opinion to the employer containing the results of the medical exams. Employee should also receive a copy of these opinion. The physician must not tell employer any conditions he detects unrelated to occupational exposure to but must tell employee those conditions.

7. Observations of Monitoring

Employer is required to monitor exposure to vinyl chloride and employee or his representative is entitled to observe the monitoring procedure. Employee is entitled to receive an explanation of the measurement procedure, and to record the results obtained. When the monitoring procedure is taking place in an area where respirators or personal protective clothing and equipment are required to be worn, employee must be provided with and must wear the protective clothing and equipment.

8. Access to Records

Employee or his representative is entitled to records of employees exposure to vinyl chloride upon request to employer. Medical examination records can be furnished to employee's physician if employee requests the employer to provide them.

9. Training and Notification

Additional information on all of these items plus training as to fire hazards and hazards of exposure to vinyl chloride and the engineering and work practice controls associated with the job will also be provided by the employer. If employee is exposed over the permissible exposure limit, employer must inform employee of that fact and the actions he is taking to reduce exposures.

4 Inorganic Arsenic

4.1 Definitions

— Action level. A concentration of inorganic arsenic of 5 micrograms/cu m of air averaged over any 8 hour period.

— Authorized person. A person specifically authorized by the employer whose duties require the person to enter a regulated area, or any person entering such an area as a designated representative of employees for the purpose of exercising the right to observe monitoring and measuring procedures under subparagraph 4.4.

— Inorganic arsenic. Copper aceto-arsenite and all inorganic compounds containing arsenic except arsine, measured as arsenic (As).

— Permissible exposure limit. Concentration of inorganic arsenic not to exceed 10 micrograms/cu m of air averaged over any 8-hour period.

4.2 Scope. This paragraph applies to all occupational exposures to inorganic arsenic except that this paragraph does not apply to employee resulting from pesticide application, the treatment of wood with preservatives or the utilization of arsenically preserved wood.

4.3 Notification of use

4.3.1 Within 60 days after the introduction of inorganic arsenic in to the workplace, every employer who is required to establish a regulated area in his workplaces shall report in writing to the concerned authorities for each such workplace:

4.3.1.1 The address of each such workplace.

4.3.1.2 The approximate number of employees who will be working in regulated areas; and

4.3.1.3 A brief summary of the operations creating the exposure and actions which the employer intends to take to reduce exposure.

4.3.2 Whenever there has been a significant change in the information required by subparagraph 4.3.1, the employer shall report the changes in writing within 60 days to the concerned authorities.

4.4 Exposure monitoring

4.4.1 Determinations of airborne exposure levels shall be made from samples that are representative of each employee’s exposure to inorganic arsenic over an 8 hour period.

4.4.1.1 For the purpose of this subparagraph, employee exposure is that exposure which would occur if the employee were not using a respirator.

4.4.1.2 The employer shall collect full shift (for at least 7 continuous hours) personal samples including at least 1 sample for each shift or each job classification in each work area.

4.4.2 Each employer who has a workplace or work operation covered by this standard shall monitor each such workplace and work operation to accurately determine the airborne concentration of inorganic arsenic to which employee may be exposed.

4.4.3. Frequency

4.4.3.1 If the initial monitoring reveals employee exposure to be below the action level the measurements need not be repeated except as otherwise provided in subparagraph 4.4.4.

4.4.3.2 If the initial monitoring, or subsequent monitoring reveals employee exposure to be above the permissible exposure limit, the employer shall repeat monitoring at least quarterly.

4.4.3.3 If the initial monitoring, or subsequent monitoring reveals employee exposure to be above the action level and below the permissible exposure limit the employer shall repeat monitoring at least every 6 months.

4.4.3.4 The employer shall continue monitoring at the required frequency until at leas two consecutive measurements, taken at least 7 days apart, are below the action level at which time the employer may discontinue monitoring for that employee until such time as any of the events in subparagraph 4.4.4, occur.

4.4.4 Whenever there has been a production, process, control or personnel change which may result in new or additional exposure to inorganic arsenic or, whenever the employer has any other reason to suspect a change which may result in new or additional exposures to inorganic arsenic, additional monitoring which complies with subparagraph 4.4 shall be conducted.

4.4.5 Employee notification

4.4.5.1 Within 5 working days after the receipt of monitoring results, the employer shall notify each employee in writing of the results each represent that employee's exposures.

4.4.5.2 Whenever the results indicate that the representative employee exposure exceed the permissible exposure limit, the employer shall include in the written notice a statement that the permissible exposure limit was exceeded and a description of the corrective action taken to reduce exposure to or below the permissible exposure limit.

4.4.6 The employer shall use a method of monitoring and measurement which has an accuracy (with a confidence level of 95 percent) of not less than ± 25 percent for concentration of inorganic arsenic greater than or equal to 10 micrograms/cu of air.

4.5 Regulated area

4.5.1 Te employer shall establish regulated areas where worker exposure to inorganic arsenic, without regard to the use of respirators, are in excess of the permissible limit.

4.5.2 Regulated areas shall be demarcated and segregated from the rest of the workplace in any manner that minimizes the number of persons who will be exposed to inorganic arsenic.

4.5.3 Access to regulated areas shall be limited to authorized persons.

4.5.4 All persons entering a regulated area shall be supplied with a respirator, selected in accordance with subparagraph 4.7.1.2.

4.5.5 The employer shall assure that in regulated areas, food or beverages are not consumed, smoking products, chewing tobacco and gum are not used and cosmetics are not applied, except that these activities may be conducted in the lunchrooms, change rooms and showers required under subparagraph 4.10. Drinking water may be consumed in the regulated area.

4.6 Methods of compliance

4.6.1 The employer shall institute at the earliest possible time engineering and work practice controls to reduce exposures to or below the permissible exposure limit, except to the extent that the employer can establish that such controls are not feasible.

4.6.2 Where engineering and work practice controls are not sufficient to reduce exposures to or below the permissible exposure limit, they shall nonetheless be used to reduce exposures to the lowest levels achievable by these controls and shall be supplemented by the use of respirators, in accordance with other necessary personal protective equipment. Employee rotation is not required as a control strategy before respiratory protection is instituted.

4.6.3 The employer shall establish and implement a written program to reduce exposures to or below the permissible exposure limit by means of engineering and work practice controls.

4.6.4 Written plans for these compliance programs shall include at least the following:

4.6.4.1 A description of each operation in which inorganic arsenic is emitted; for example, machinery used, materials processed, controls in place, crew size, operating procedures and maintenance practices:

4.6.4.2 Engineering plans and studies used to determine methods selected for controlling exposure to inorganic arsenic;

4.6.4.3 A report of the technology considered in meeting the permissible exposure limit;

4.6.4.4 Monitoring data;

4.6.4.5 A detailed schedule for implementation of the engineering controls and work practices that cannot be implemented immediately and for the adaption and implementation of any additional engineering and work practices necessary to meet the permissible exposure limit.

4.6.4.6 Whenever the employer will not achieve the permissible exposure limit with engineering controls and work practices, the employer shall include in the compliance plan an analysis of the effectiveness of the various controls, shall install engineering controls and institute work practices on the quickest schedule feasible, and shall include in the compliance plan and implement a program to minimize the discomfort and maximize the effectiveness of respirator use; and.

4.6.4.7 Other relevant information

4.6.5 Written plans for such a program shall be submitted upon request to the concerned authorities and shall be available at the worksite for examination and copying by the concerned authorities, and affected employee or authorized employee representatives.

4.6.6 The plans required by this subparagraph shall be revised and updated at least every 6 months to reflect the current status of the program.

4.7 Respiratory protection

4.7.1 The employer shall assure that respirators are used where required, to reduce employee exposures to below the permissible exposure limit and in emergencies. Respirators shall be used in the following circumstances:

4.7.1.1 During the time period necessary to install or implement feasible engineering or work practice controls;

4.7.1.2 In work operations such as maintenance and repair activities in which the employer establishes that engineering and work practice controls are not feasible;

4.7.1.3 In work situations in which engineering controls and supplemental work practice controls are to yet sufficient to reduce exposures to or below the permissible exposure limit, or

4.7.1.4 In emergencies.

4.7.2 Where respirators are required the employer shall select, provide at no cost to the employee and assure the use of the appropriate respirator or combination of respirators from Table 1 for inorganic arsenic compounds without significant vapor pressure, or Table 2 for inorganic arsenic compounds which have significant vapor pressure.

4.7.3 Where employee exposure exceed the permissible exposure limit for inorganic arsenic and also exceed the relevant limit for particular gases such as sulfur dioxide, any air purifying respirator supplied to the employee as permitted by this standard must have a combination high efficiency filter with an appropriate gas sorbent. (see footnote in Table 1).

Table 1

Respiratory protection for inorganic arsenic particulate except for those with significant vapor pressure

Concentration of inorganic arsenic (as As) or condition of use	Required respirator
Unknown or greater or lesser than 20,000 micrograms/cu m (20 mg/cu m) or firefighting	(A) Any fullface piece self-contained breathing apparatus operated in positive pressure mode.
Not greater than 20,000 micrograms/cu m (20 mg/cu m)	(A) Supplied air respirator will full face piece, hood, or helmet or suit and operated in positive pressure mode.
Not greater than10,000 micrograms/cu m (10 mg/cu m)	(A) Powered air-purifying respirators in all inlet face coverings with high efficiency filters [1)] (B) Half-mask supplied air respirators operated in positive pressure mode.
Not greater than 500 micrograms/cu m	(A) Full facepiece air-purifying respirator equipped with high-efficiency filter.[1)] (B) Any full facepiece supplied air respirator (C) Any full face piece self-contained breathing apparatus.
Not greater than 100 micrograms/cu m	(A) Half-mask air-purifying respirator equipped with high-efficiency filter.[1)] (B) Any half-mask supplied air respirator.

1) High-efficiency filter – 99-97 percent efficiency against 0.3 micrometer monodisperse diethyl-hexyl phthalate (DOP) particles.

Table 2

Respiratory protection for inorganic arsenic (Such as arsenic trichloride2 and arsenic phosphide) with significant vapor pressure

Concentration of inorganic arsenic (as As) or condition of use	Required respirator
Unknown or greater or lesser than 20,000 micrograms/cu m (20 mg/cu m) or firefighting	(A) Any full facepiece self-contained breathing apparatus operated in positive pressure mode.
Not greater than 20,000 micrograms/cu m (20 mg/cu m)	(A) Supplied air respirator will full facepiece, hood, or helmet or suit and operated in positive pressure mode.
Not greater than10,000 micrograms/cu m (10 mg/cu m)	(A) Half-mask[2] supplied air respirators operated in positive pressure mode.
Not greater than 500 micrograms/cu m	(A) Front or back mounted gas mask equipped with high-efficiency filter.[1)]and acid gas canister. (B) Any full facepiece supplied air respirator (C) Any full facepiece self-contained breathing apparatus.
Not greater than 100 micrograms/cu m	(A) Half-mask[2] air-purifying respirator equipped with high-efficiency filter.[1)] and acid gas cartridge. (B) Any half-mask supplied air respirator.

1) High-efficiency filter – 99,97 percent efficiency against 0.3 micrometer monodisperse diethyl-hexyl phthalate (DOP) particles.

2) Half-mask respirators shall not be used for protection against arsenic trichloride, as it its rapidly absorbed through the skin.

4.7.4 The employer shall select respirators from among those approved for protection against dust, fume, and mist.

4.7.5 The employer shall assure that the respirator issued to the employee exhibits minimum facepiece leakage and that the respirator is fitted properly.

4.7.6 The employer shall perform qualitative fit tests at the time on initial fitting and at least semi-annually thereafter for each employee wearing respirators, where quantitative fit tests are not required.

4.7.7 Employers with more than 20 employees wearing-respirators shall perform a quantitative face fit test at the time of initial fitting and at least semi-annually thereafter for each employee wearing negative pressure respirators. The test shall

be used to select facepieces that provide the required protection as protection din Table 1 or 2.

4.7.8 If an employee has demonstrated difficulty in breathing during the fitting test or during use, he shall be examined by a physician trained in pulmonary medicine to determine whether the employee can wear a respirator while performing the required duty.

4.7.9 The employer shall institute a respiratory protection program in accordance with section 5.3.

4.7.10 The employer shall permit each employee who uses a filter respirator to change the filter elements whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

4.7.11 Employees who wear respirators shall be permitted to leave work areas to ash their face and respirator facepiece to prevent skin irritation associated with respirator use.

4.7.12 The employer's obligation is to provide respirators for employees exposed to over 10 micrograms/cu m of inorganic arsenic.

4.7.13 Any employee required to wear respirators may choose, and if so chosen the employer must provide, if it will give proper protection, a powered air purifying respirator and in addition if necessary a combination dust and acid gas respirator for times where exposures to gases are over the relevant exposure limits.

4.8 Protective work clothing and equipment

4.8.1 Where the possibility of skin or eye irritation from inorganic arsenic exists, and for all workers working in regulated areas, the employer shall provide at no cost to the employee and assures that employees use appropriate and clean protective work clothing and equipment such as, but not limited to:

4.8.1.1 Coveralls or similar full-body work clothing;

4.8.1.2 Gloves, and shoes or coverlets;

4.8.1.3 Face shields or vented goggles when necessary to prevent eye irritation.

4.8.1.4 Impervious clothing for employees subject to exposure to arsenic trichloride.

4.8.2 The employer shall provide the protective clothing required in freshly laundered and dry conditions at least weekly, and daily if the employee works in areas where exposures are over 100 micrograms/cu m of inorganic arsenic or in areas where more frequent washing in needed to prevent skin irritation.

4.8.3 The employer shall clean, launder, or dispose of protective clothing required by subparagraph 4.8.1.

4.8.4 The employer shall repair or replace the protective clothing and equipment as needed to maintain their effectiveness.

4.8.5 The employer shall assure that all protective clothing is removed at the completion of a work shift only in change rooms prescribed in subparagrph 4.10.1.

4.8.6 The employer shall assure that contaminated protective clothing which is to be cleaned, laundered, or disposed of, is placed in a closed container in the change room which prevents dispersion of inorganic arsenic outside the container.

4.8.7 The employer shall inform in writing any person who cleans or launders clothing of the potentially harmful effects including the carcinogenic effects of exposure to inorganic arsenic.

4.8.8. The employer shall assure that the containers of contaminated protective clothing and equipment in the workplace or which are to be removed form the workplace are labeled as follows:

CAUTION: Clothing contaminated with inorganic arsenic; do not remove dust by blowing or shaking. Dispose of inorganic arsenic contaminated wash water in accordance with applicable regulations.

4.8.9 The employer shall prohibit the removal of inorganic arsenic from protective clothing or equipment by blowing or shaking.

4.9 Housekeeping

4.9.1 All surface shall be maintained as free as practicable of accumulations of inorganic arsenic.

4.9.2 Floors and other accessible surfaces contaminated with inorganic arsenic may not be cleansed by the use of compressed air, and shoveling and brushing may be used only where vacuuming or other relevant methods have been tried and found not to be effective.

4.9.3 Where vacuum methods are selected, the vacuum shall be used and emptied in a manner to minimize the reentry of inorganic arsenic into the workplace.

4.9.4 A written housekeeping and maintenance plan shall be kept which shall list appropriate frequencies for carrying out housekeeping operations, and for cleaning and maintaining dust collection equipment. The plan shall be available for inspection by the concerned authorities.

4.9.5 Periodic cleaning of dust collection equipment and checks of their effectiveness shall be carried out to maintain the effectiveness of the system and a notation kept of the last check of effectiveness and cleaning or maintenance.

4.10 Hygiene facilities and practices.

4.10.1 The employer shall provide for employees working in regulated areas or subject to the possibility of skin or eye irritation form inorganic arsenic, clean change room equipped with storage facilities for street clothes and separate storage facilities for protective clothing and equipment.

4.10.2 The employer shall assure that employees working in regulated areas or subject to the possibility of skin or eye irritation from inorganic arsenic shower at the end of the work shift in employer provided shower facilities.

4.10.3 The employer shall provide for employees working in regulated areas, lunchroom facilities which have a temperature controlled, positive pressure, filtered air supply, and which are readily accessible to employees working in regulated areas.

4.10.4 The employer shall assure that employees working in the regulated area or subject to the possibility of skin or eye irritation from exposure to inorganic arsenic wash their hands and face prior to eating in employer provided lavatory facilities.

4.10.5 The employer shall provide facilities for employees working in areas where exposure, without regard to the use of respirators, exceeds 100 micrograms/cu m to vacuum their protective clothing and clean or change shoes worn in such areas before entering change rooms, lunchrooms or shower rooms required and shall assure such employees use which facilities.

4.10.6 The employer shall assure that no employee is exposed to skin or eye contact with arsenic trichloride, or to skin or eye contact with liquid or particulate inorganic arsenic which is likely to cause skin or eye irritation.

4.11 Medical surveillance

4.11.1 The employees shall institute a medical surveillance program for the following employees:

4.11.1.1 All employees who are or will be exposed above the action level, without regard to the use of respirators, at least 30 days per year; and

4.11.1.2 All employees who have been exposed above the action level, without regard to respirator use, for 30 days or more per year for a total of 10 years or more of combined employment with the employer or predecessor employers prior to or after the effective date of this standard. Te determination of exposure prior to the effective date of this standard shall be based upon prior exposure records, comparison with the first measurements taken after the effective date of this standard, or comparison with records of exposures in areas with similar processes, extent of engineering controls utilized and materials used by that employer.

4.11.2 The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and shall be provided without cost to the employee, without loss of pay and at a reasonable time and place.

4.11.2.1 A work history and a medical history which shall include a smoking history and the presence and degree of respiratory symptoms such as breathlessness, cough, sputum production and wheezing.

4.11.2.2 A medical examination which shall include at least the following:

— A 35 cm x 43 cm posterior-enterior check X-ray.

— A nasal and skin examination.

— A sputum cytology examination.

Other examinations which the physician believes appropriate because of the employee’s exposure to inorganic arsenic or because of req2uired respirator use.

4.11.3 The employer shall provide the examinations specified in subparagraphs 4.11.2.1 and4.11.2.2 at least annually for covered employees who are under 45

years for age with fewer than 10 years of exposure over the action level without regarded to respirator use.

4.11.4 The employer shall provide the examinations at least semiannually for other covered employees.

4.11.5 Whenever a covered employee has not taken the examination within 6 months preceding the termination of employment, the employer shall provide such examinations to the employee upon termination of employment.

4.11.6 If the employee for any reason develops signs or symptoms commonly associated with exposure to inorganic arsenic the employer shall provide an appropriate examination and emergency medical treatment.

4.11.7 The employer shall provide the following information to the examining physician:

— A copy of this standard and its appendices;

— A description of the affected employee's duties as they relate to the employee's exposure;

— The employee's representative exposure level or anticipated exposure level;

— A description of any personal protective equipment used or to be used; and

— Information from previous medical examinations of the affected employee which is not readily available to the examining physician.

4.11.8 The employer shall obtain a written opinion from the examining physical which shall include:

— The results of the medical examination and tests performed.

— The physician's opinion as to whether the employee has any detected medical conditions which would place the employee at increased risk of material impairment of the employee's health from exposure to inorganic arsenic.

— Any recommended limitations upon the employee's exposure to inorganic arsenic or upon the use of protective clothing or equipment such as respirators.

— A statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions which further explanation or treatment.

4.11.9 The employer shall instruct the physician not to reveal in the written opinion specific findings or diagnoses unrelated to occupational exposure.

4.11.10 The employer shall provide a copy of the written opinion to the affected employee.

4.12 Employee information and training

4.12.1 The employer shall institute a training program for all employees who are subject to exposure to inorganic arsenic above the action level without regard to respirator

use, or for whom there is the possibility of skin or eye irritation from inorganic arsenic. The employer shall assure that those employees participate in the training program.

4.12.2 The training program shall be provided for employees covered by this provision, at the time of initial assignment for those subsequently covered by this provision, and shall be repeated at least quarterly for employees who have optional use of respirators and at least annually for other covered employees thereafter; and the employer shall assure that each employee is informed of the following:

— The information contained in Appendix A:

— The quantity, location, manner of use, storage, sources of exposure; and the specific nature of operations which could result in exposure to inorganic arsenic as well as any necessary protective steps;

— The purpose, proper use, and limitation of respirators;

— The purpose and description of the medical surveillance program as required by subparagraph 4.11.

— The engineering controls and work practices associated with the employee's job assignment.

4.12.3 The employer shall make readily available to all affected with the employees a copy of this standard and its appendices.

4.12.4 The employer shall provide, upon request, all materials relating to the employee information and training program to the concerned authorities.

4.13 Signs and labels

4.13.1 The employer may use labels or signs required by other statutes, regulations, or ordinances in addition to, or in combination with, signs and labels required.

4.13.2 The employer shall assure that no statement appears on or near any sign or label required which contradicts or detracts from the meaning of the required sign or label.

4.13.3 The employer shall post signs demarcating regulated areas bearing the legend;

DANGER
INORANIC ARSENIC
CANCER HAZARD
AUTHORIZED PERSONNEL ONLY
NO SMOKING OR EATING
RESPIRATOR REQUIRED

4.13.4 The employer shall assure that signs required by this subparagraph are illuminated and cleaned as necessary so that the legend is readily visible.

4.13.5 The employer shall apply precautionary labels to all shipping and storage containers of inorganic arsenic and to all products containing inorganic arsenic in the product is bound in such a manner so as to made unlikely the possibility of airborne exposure to inorganic arsenic. (Possible examples of products not

requiring labels are semiconductors. Light emitting diodes and glass). The label shall bear the following legend:

DANGER
CONTAINS INORGANIC ARSENIC
CANCER HAZARD
HARMFUL IF INHALED OR SWALLOWED
USE ONLY WITH ADEQUATE VENTILATION
OR RESPIRATORY PROTECTIION

4.14 Record keeping

4.14.1 The employer shall establish and maintains as accurate record of all monitoring required.

4.14.2 This record shall include:

— The date(s), number, duration, location, and results of each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure where applicable.

— A description of the sampling and analytical methods used and evidence of their accuracy.

— The type of respiratory protective devices worn, if any.

— Name, number, and job classification of the employees monitored and of all other employees whose exposure the measurement is intended to represent.

— The environmental variables that could affect the measurements of the employee's exposure.

4.14.3 The employer shall maintain these monitoring records for at least 40 years of for the duration of employment plus 20 years, whichever is longer.

4.14.4 The employer shall establish and maintain an accurate record for each employee subject to medical surveillance as required.

4.14.5 The record shall include:

— The name, number and description of duties of the employee.

— A copy of the physician's written opinions.

— Results of any exposure monitoring done for that employee and the representative exposure levels supplied to the physician.

— Any employee medical complaints related to exposure to inorganic arsenic.

4.14.6 The employer shall in addition keep, or assure that the examining physician keeps, the following medical records.

— A copy of the medical examination results including medical and work history required.

— A description of the laboratory procedures and a copy of any standards or guidelines used to interpret the test results or references to that information:

— The initial X-ray.

— The X-rays for the most recent five years.

— Any X-rays with a demonstrated abnormality and all subsequent X-rays.

— The initial cytologic examinations slide and written description.

— The cytologic examination slide and written description for the most recent five years.

— Any cytologic examination slides with demonstrated atypia, if such atypia persists for three years, and all subsequent slides and written descriptions.

4.14.7 The employer shall maintain or assure that the physician maintains those medical records for at least 40 years, or for the duration of employment plus 20 years whichever is longer.

4.14.8 The employer shall make available upon request all records required to be maintained to the concerned authorities.

4.14.9 The employer shall make available upon request all records of employer exposure monitoring required for inspection and copying to affected employees, former employees and their designated representatives.

4.14.10 The employer shall made available upon request an employee's medical records and exposure records representative of that employee's exposure required to be maintained to the affected employee or former employee or to a physician designated by the affected employee or former employee.

4.14.11 Whenever the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained.

4.14.12 Whenever the employer ceases to do business and there is no successor employer to remove and retain the records required to be maintained for the prescribed period, these records shall be transmitted to the concerned authorities.

4.14.13 At the expiration of the retention period for the records required to be maintained by this section, the employer shall notify the concerned authorities at least three months prior to the disposal of such records and shall transmit those records to the concerned authorities if required.

4.15 Observation of monitoring.

4.15.1 The employer shall provide affected employee or their designated representatives an opportunity to observe any monitoring of employee exposure to inorganic arsenic conducted.

4.15.2 Whenever observation of the monitoring of employee exposure to inorganic arsenic requires entry into an area where the use of respirators, protective clothing, or equipment is required, the employer shall provide the observer with and assure the use of such respirators, clothing, and such equipment, and shall require the observer to comply with all other applicable safety and health procedures.

4.15.3 Without interfering with the monitoring, observers shall be entitled to:

— Receive an explanation of the measurement procedures.

— Observe all steps related to the monitoring of inorganic arsenic performed at the place or exposure.

— Record the results obtained or receive copies of the results when returned by the laboratory.

4.16 Appendices: The information contained in the appendices to this section is not intended by itself, to create any additional obligations not otherwise imposed by this standard not detract from any existing obligation.

4.17 Regulated areas: Regulated areas required to be established as result of initial monitoring shall be set up as soon as possible after the results of that monitoring is known.

4.18 Compliance programs: The written program required as a result of initial monitoring shall be made available for inspection and copying as soon as possible.

Appendix A

Inorganic Arsenic Substance Information Sheet

1. Substance identification

A. Substance, Inorganic Arsenic.

B. Definition. Copper acetoarsenite, arsenic and all inorganic compounds containing arsenic except arsine, measured as arsenic (As).

C. Permissible exposure limit. 10 micrograms/cu m of air as determined as an average over an eight hour period. No employee may be exposed to any skin or eye contact with arsenic trichloride or to skin or eye contact likely to cause skin or eye irritation.

D. Regulated areas. Only employees authorized by his employer should enter a regulated area.

2. Health hazard data

A. Comments. The health hazard of inorganic arsenic is high.

B. Ways in which the chemical affects your body. Exposure to airborne concentrations of inorganic arsenic may cause lung cancer, and can be a skin irritant. Inorganic arsenic may also affect the body if swallowed. One compound in particular, arsenic trichloride, is especially dangerous because it can be absorbed readily through the skin. Because inorganic arsenic is a poison, employee should was hands thoroughly prior to eating or smoking.

3. Protective clothing and equipment

A. Respirators. Respirators will be provided by employer at no cost for routine use if employer is in the process of implementing engineering and work practice controls are not feasible or insufficient. Respirators must be worn for nonroutine activities or in emergency situations where exposure to levels of inorganic arsenic in excess of the permissible exposure limit. Respirator fit to the face is very important. Employer is required to conduct fit tests to make sure the respirator seals properly when worn. These tests are simple and rapid and will be explained during training sessions.

B. Protective clothing. If employee works in a regulated area, employer is required to provide at no cost to employee, and employee must wear appropriate, clean, protective clothing and equipment. The purpose of this equipment is to prevent carrying home arsenic-contaminated dust and to protect the body from repeated skin contact with inorganic arsenic likely to cause skin irritation. This clothing should include such items as coveralls or similar full-body clothing, gloves, shoes or coverlets, and aprons. Protective equipment shall include face shields or vented goggles, where eye irritation may occur.

4. Hygiene facilities and practices

Employee must not eat, drink, smoke, chew gum or tobacco, or apply cosmetics in the regulated area, except that drinking water is permitted. If employee works in a

regulated area, employer is required to provide lunchrooms and other areas for these purposes.

If employee works in a regulated area, employer is required to provide showers, washing facilities, and change rooms. Employee must wash face and hands before eating and must shower at the end of the work shift. Do not take used protective clothing out of change rooms without employer's permission. Employer is required to provide for laundering or cleaning of protective clothing.

5. Signs and labels

Employer is required to post warning signs and labels for employee protection. Signs must be posted in regulated areas. The signs must warn that a cancer hazard is present, that only authorized employees may enter the area, and that no smoking or eating is allowed, and that respirators must be worn.

6. Medical examinations

If exposure to arsenic is over the Action Level (5 micrograms/cu m – including all persons working in regulated areas) at least 30 days per year, or employee has been exposed to arsenic for more than 10 years over the Action Level, employer is required to provide a medical examination. The examination shall be every six months for employees over 45 years old or with more than 10 years exposure over the Action Level and annually for other covered employees. The medical examination must include a medical history; a chest x-ray; skin examination; nasal examination and sputum cytology exam for the early detection of lung cancer. The cytology exams are only included in the initial exam and examinations given after employee is either 45 years or older or has 10 or more years employment over the Action Level. The examining physician will provide a written opinion to the employer containing the results of the medical exams. Employees should also receive a copy of this opinion. The physician must not tell employer any conditions he detects unrelated to occupational exposure to arsenic but must tell employee those conditions.

7. Observation of Monitoring

Employer is required to monitor exposure to arsenic and employee or his representative is entitled to observe the monitoring procedure. Employee is entitled to receive an explanation of the measurement procedure, and o record the results obtained. When the monitoring procedure is taking place in an area where respirators or personal protective clothing and equipment are required to be worn, employee must also be provided with and must wear the protective clothing and equipment.

8. Access to Records

Employer or his representative is entitled to records of employees exposure to inorganic arsenic upon request to employer. Medical examination records can be furnished to employee's physician if employee requests the employer to provide them.

9. Training and Notification

Additional information on all of thee items plus training as to hazards of exposure to inorganic arsenic and the engineering and work practices controls associated with the job will also be provided by the employer. If employee is exposed over the permissible exposure limit, employer must inform employee of that fact and the actions he is taking to reduce exposure.

Appendix B

Substance Technical Guidelines

ARSENIC, ARSENIC TRIOXIDE. ARSENIC TRICHLORIDE

(Three Examples)

1. Physical and Chemical Properties

A. Arsenic (metal)

1. Chemical Symbol: As
2. Appearance: Gray metal
3. Melting Point: Sublimes without melting at 613^{o}C.
4. Specific Gravity: (H_2O = 1): 5.73
5. Solubility in Water: Insoluble

B. Arsenic Trioxide

1. Formula: As_2O3, (As_4O_6)
2. Appearance: White powder
3. Melting point: 315^{o}C
4. Specific gravity (H_2O = 1) 3.74
5. Solubility in water: 3.7 gm in 100 cc of water at 20^{o}C.

C. Arsenic Trichloride (Liquid)

1. Formula: $AsCl_3$
2. Appearance: Colorless or plate yellow liquid
3. Melting Point: -85^{o}C
4. boiling Point: 130.2^{o}C
5. Specific Gravity (H2O = 1): 2.16 at 20^{o}C.
6. Vapor Pressure: 10 mm Hg at 23.5^{o}C.
7. Solubility in water: Decomposes in water

2. Fire, Explosion and Reactivity Data

A. Fire: Arsenic, Arsenic Trioxide and arsenic Trichloride are nonflammable.

B. Reactivity:

1. Conditions contributing to Instability: Heat
2. Incompatibility: Hydrogen gas can react with inorganic arsenic to form the highly toxic gas arsine.

3. Monitoring and Measurement Procedures

Samples collected should be full shift (at least seven hours) Samples. Sampling should be done using a personal sampling pump at a flow rate of two liters/min. Samples should be collected on 0.8 micrometer pore size membrane filter (3.7 cm diameter). Volatile arsenicals such as arsenicals trichloride can be most easily collected in a midget bubbler filled with 15 ml. of 0.1 N NaOH.

The method of sampling and analysis should have an accuracy of not less than ± 25 percent (with a confidence limit of 95 percent) for 10 micrograms/ cu m of air and ± 35 percent (with a confidence limit of 95 percent) for concentrations of inorganic arsenic between 5 and 10 micrograms/cu m.

APPENDIX C

Medical surveillance Guidelines

1. General

Medical examinations are to be provided for all employees exposed to levels of inorganic arsenic above the action level (5 micrograms/cu m) for at least 20 days per year (which would include among others, all employees who have had 10 years or more exposure above the action level for more than 30 days per year while working for the present or predecessor employer though they may no longer by exposed above the level.

An initial medical examination is to be provided to all such employees. In addition, an initial medical examination is to be provided to all employees who are first assigned to areas in which worker exposure will probably exceed 5 micrograms/cu m at the time of initial assignment. In addition to its immediate diagnostic usefulness, the initial examination will provide a baseline for comparing future test results. The initial examination must include as a minimum the following elements:

1. A work and medical history, including a smoking history, and presence and degree of respiratory symptoms such as breathlessness, cough, sputum production, and wheezing:
2. A 35 x 43 cm posterior-anterior chest x-ray.
3. A nasal and skin examination.
4. A sputum cytology examination.
5. Other examinations which the physician believes appropriate because of the employee’s exposure to inorganic arsenic or because of required respirator use.

Periodic examinations are also to be provided to the employees listed above. The periodic examinations shall be given annually for those covered employees 45 years of age or less with fewer than 10 years employment in areas where employee exposure exceed the action level (5 micrograms/cu m). Periodic examinations need not include sputum cytology and only an updated medical history is required.

Periodic examinations for other covered employees shall be provided every 6 months. These examinations shall include all tests required in the initial examination, except that the medical history need only be updated.

The examination contents are minimum requirements. Additional tests such as lateral and oblique X-rays or pulmonary functions tests may be useful. For workers exposed to three arsenicals which are associated with lymphatic cancer, copper acetoarsenite, potassium arsenite, or sodium arsenite; the examination should also include palpation of superficial lymph nodes and complete blood count.

2. Sputum Cytology

Sputum can be collected by aerosol inhalation during the medical exam or by spontaneous early morning cough at home. Sputum is induced by transoral inhalation or an aerosolized solution of 8 percent sodium chloride in water. After inhaling as few as 3 to 5 breaths, the subject usually yields an adequate sputum. All sputum should be collected directly into 60 percent alcohol.

Scientific evidence suggests that chest X-rays and sputum cytology should be used together as screening tests for lung tests for lung cancer in high risk populations such as workers exposed to inorganic arsenic. The tests are to be performed every 6 months on workers who are 45 years of age or older or have worked in the regulated area for 10 or more years. Since the tests seem to be complementary, it may be advantageous to alternate the test procedures. For instance, chest X-rays could be obtained in June and December and sputum cytologies could be obtained in March and September. Facilities for providing necessary diagnostic investigation should be readily available as well as chest physicians, surgeons, radiologists, pathologist and immunotherapists to provide any necessary treatment services.

5 Lead

5.1 Definitions

— Action level, Employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 30 micrograms/cu m of air averaged over an 8-hour period.

— Exmployee Exposure. That exposure which would occur if the employee were not using a respirator.

— Lead. Metallic lead, all inorganic lead compounds, and organic lead soaps. Excluded from this definition are all other organic lead compounds.

5.2 Scope. This paragraph applies to all occupational exposure to lead except work for construction, alteration, and/or repair, including painting and decorating or to agricultural operations.

5.3 Permissible exposure limit (PEL)

5.3.1 The employer shall assure that no employee is exposed to lead at concentrations greater than 50 micrograms/cu m of air averaged over an 8-hour period.

5.3.2 If an employee is exposed to lead for more than 8 hours in any work day, the permissible exposure limit, as time weighted average (TWA) for that day, shall be reduced according to the following formula:

Maximum permissible limit (microgram/cu m) = 400 – hours worked in a day.

5.3.3 When respirators are used to comply with the PEL and all the requirements of subparagraph 5.6 have been met, employee exposure, for the purpose of determining whether the employer has complied with the PEL, may be considered to be at the level provided by the protection factor of the respirator for those periods the respirators is worn. Those periods may be average with exposure levels during periods when respirator are not worn to determine the employee's daily TWA exposure.

5.4 Exposure Monitoring

5.4.1 With the exception of monitoring under subparagraph 5.4.4 the employer shall collect full shift (for at least 7 continuous hours) personal samples including at least one sample for each shift for each job classification in each work area.

5.4.2 Full shift personal samples shall be representative of the monitored employee's regular daily exposure to lead.

5.4.3 Each employer who has a workplace or work operation shall determine if any employee may be exposed to lead at or above the action level.

5.4.4 Basis of initial determination

5.4.4.1 The employer shall monitor employee exposure and shall base initial determinations on the employee exposure monitoring results and any of the following, relevant considerations:

5.4.4.4.1.1 Any information, observation, or calculations which would indicate employee exposure to lead;

5.4.4.1.2 Measurements or airborne lead made in the preceding year if the sampling and analytical methods used meet the accuracy and confidence levels of subparagraph 5.4.10 and;

5.4.4.1.3 Any employee complaints of symptoms which may be attributable to exposure to lead.

5.4.4.2 Monitoring for the initial determination may be limited to a representative sample of the exposed employees who the employer reasonably believes are exposed to the greatest airbone concentrations of lead in the workplace.

5.4.5 Where a determination conducted under subparagraphs 5.4.3 and 5.4.4 shows the possibility of any employee exposure at or about the action level, the employer shall conduct monitoring which is representative of the exposure for each employee in the workplace which is exposed to lead.

5.4.6 Where and determination, conducted under subparagraphs 5.4.3 and 5.4.4. is made that no employee is exposed to airborne concentrations of lead at or above the action level, the employer shall make a written record of such determination. The record shall include at least the information specified in subparagraph 5.4.4 and shall also include the date or determination, location within the worksite, and the name of each employee monitored.

5.4.7 Frequency

5.4.7.1 If the initial monitoring reveals employee exposure to be below the action level the measurements need not be repeated expect as otherwise provided in subparagraph 5.4.8.

5.4.7.2 If the initial determination or subsequent monitoring reveals employee exposure to be at or above the action level but below the permissible exposure limit the employer shall repeat monitoring in accordance with this paragraph at least every 6 months. The consecutive measurements, taken at least 7 days apart, are below the action level at which time the employer

may discontinue monitoring for that employer except as other wise provided in subparagraph 5.4.8.

5.4.7.3 If the initial monitoring reveals that employee exposure is above the permissible exposure limit the employer shall repeat monitoring quarterly. The employer shall continue monitoring at the required frequency until at least two consecutive measurement, taken at least 7 days apart, are below the PEL but at or above the action level at which time the employer may repeat monitoring for that employee at the frequency specified in subparagraph 5.4.7.2, except as otherwise provided in subparagraph 5.4.8.

5.4.8 Whenever there has been a production, process, control or personnel change which may result in new or additional exposure to lead, or whenever the employer has any other reason to suspect a change which may result in new or additional exposure to lead, additional monitoring in accordance with this subparagraph shall be conducted.

5.4.9 Employee notification

5.4.9.1 Within 5 working days after the receipt of monitoring results, the employer shall notify each employee in writing of the results which represent that employee's exposure.

5.4.9.2 Whenever the results indicate that the representative employee exposure, without regard to respirators, exceeds the permissible exposure limit, the employer shall include in the written notice a statement that the permissible exposure limit was exceeded and a description of the corrective action taken or to be taken to reduce exposure to or below the permissible exposure limit.

5.4.10 The employer shall use a method of monitoring and analysis which has an accuracy (to a confidence level of 95 percent) of not less than ± 20 percent for airborne concentrations of lead equal to or greater than 30 micrograms/cu m.

5.5 Methods of compliance

5.5.1 Where employee exposure is above the 50 micrograms/cu m permissible exposure limit, the employer shall provide respirators in accordance with subparagraph 5.6.

5.5.2 Compliance shall include items required under subparagraphs 5.7 and 5.8.

5.6 Respiratory Protection

5.6.1 Where the use of respirators is required the employer shall provide, at no cost to the employee, and assure the use of respirators which comply with the requirements of this paragraph. Respirators shall be use das follows:

5.6.1.1 No employer shall require an employee to wear a respirator longer than 4.4 hours per day; and

5.6.1.2 Whenever an employee requested a respirator.

5.6.2 Respirator selection

5.6.2.1 Where respirators are required, the employer shall select the appropriate respirator or combination of respirators from Table 4.5-4.

5.6.2.2 The employer shall provide a powered, air-purifying respirator on lieu of the respirator specified in Table 4.5-4 whenever the physical characteristics of the employee are such that the respiraors specified are in adequate for the employee's protection.

5.6.2.3 The employer shall select respirators from among those approved for protection against lead dust, fume, and mist.

5.6.3 Respirator usage

5.6.3.1 The employer shall assure that the respirator issued to the employee exhibits minimum face piece leakage and that the respirator is fitted properly.

5.6.3.2 Employers shall perform quantitative face fit tests at the time of initial fitting and at least semiannually thereafter for each employee wearing negative pressure respirators. Te test shall be used to select face pieces that provide protection as prescribed in Table 4.5-4.

5.6.3.3 If an employee exhibits difficulty in breathing during the fitting test or during use, the employer shall make available to the employee an examination in accordance with subparagraph 5.9.8.3 to determine whether the employee can wear a respirator while performing the required duty.

5.6.4 Respirator program

5.6.4.1 The employer shall institute a respiratory protection program, in accordance with Section 5.3.

5.6.4.2 The employer shall permit each employee who uses a filter respirator to change the filter elements whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

5.6.4.3 Employees who wear respirators shall be permitted to leave work areas to wash their face and respirator face piece whenever necessary to prevent skin irritation associated with respirator use.

5.7 Protective work clothing and equipment

5.7.1 If an employees is exposed to lead above the PEL, without regard to the use of respirators or where the possibility of skin or eye irritation exists, the employer shall provide at no cost to the employee and assure that the employee uses appropriate protective work clothing and equipment such as, but not limited to:

— Coveralls or similar full-body work clothing;

— Gloves, hats, and shoes or disposable shoe coverlets; and

— Face shields, vented goggles, or other appropriate protective equipment which complies with Section 5.2.

5.7.2 Cleaning and Replacement

5.7.2.1 The employer shall provide the protective clothing required in subparagraph 5.7.1 in a clean and dry condition at least weekly, and daily to employee whose exposure level without regard to a respirator are over 200 micrograms/ cu m of lead as an 8-hour TWA.

5.7.2.2 The employer shall provide for the cleaning, laundering, or disposal of protective clothing and equipment required by subparagraph 5.7.1

5.7.2.3 The employer shall repair or replace required protective clothing and equipment as needed to maintain their effectiveness.

5.7.2.4 The employer shall assure that all protective clothing is removed at the completion of a work shift only in change rooms provided for that purpose.

Table 4.5-4

Respiratory Protection for Lead Aerosols

Airborne concentration of lead or condition of use	Required respirator (1)
Not in excess of 0.5 mg/m^3 (10 x PEL)	Half-mask, air-purifying respirator equipment with high efficiency filters (2.3)
Not in excess of 2.5 mg/m^3 (50 x PEL)	Full facepiece, air-purifying respirator with high effiiciency filters.
Not in excess of 50 mg/m^3 (1000 x PEL)	(1) Any powered, air-purifying respirator with high efficiency filters; or (2) Half-mask supplied-air respirator operated in positive pressure mode. (2)
Not in excess of 100 mg/m^3 (2000 x PEL)	Supplied-air respirators with full facepiece, hood, helmet, or suit, operated in positive pressure mode.
Greater than 100 mg/m^3 unkown concentration or fire fighting	Full facepiece, self-contained breathing apparatus operated in positive-pressure mode.

1) Respirators specified for high concentration can be used at lower concentrations of lead.

2) Full facepiece is required if the lead aerosols cause eye or skin irritation at the use concentrations.

3) A high efficiency particulate filter means 99-97 percent efficient against 0.3 micron size particles.

5.7.2.5 The employer shall assure that contaminated protective clothing which is to be cleaned, laundered, or disposed of, is placed in a closed container in the change-room which prevents dispersion of lead outside the container.

5.7.2.6 The employer shall inform in writing any person who cleans or launders protective clothing or equipment of the potentially harmful effects of exposure to lead.

5.7.2.7 The employer shall assure that the containers of contaminated protective clothing and equipment required by subparagraph 5.7.2.5 are labeled as follows:

CAUTION: CLOTHING CONTAMINATED WITH LEAD, DO NOT REMOVE DUST BY BLOWING OR SHAKING. DISPOSE OF LEAD CONTAMINATED WASH WATER IN ACCORDANCE WITH APPLICABLE REGULATION.

5.7.2.8 The employer shall prohibit the removal of lead from protective clothing or equipment by blowing, shaking, or any other means which disperses lead into the air.

5.8 Housekeeping

5.8.1 All surfaces shall be maintained as free as practicable of accumulations of lead.

5.8.2 Cleaning floors

5.8.2.1 Floors and other surfaces where lead accumulated may not be cleaned by the use of compressed air.

5.8.2.2 Shoveling, dry or wet sweeping and brushing may be used only where vacuuming has been tried and found not to be effective.

5.8.3 Where vacuuming methods are selected, the vacuums shall be used and emptied in a manner which minimizes the re-entry of lead into the workplace.

5.9 Medical surveillance

5.9.1 The employer shall institute a medical surveillance program for all employees who are or may be exposed above at the action level for more than 30 days per year.

5.9.2 The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician.

5.9.3 The employer shall provide the required medical surveillance without cost to employees and at a reasonable time and place.

5.9.4 The employer shall make available biological monitoring in the form of blood sampling and analysis for lead level to each employee covered under subparagraph 5.10.1 on the following schedule:

— At least every 6 months to each employee covered.

— At least every two months for each employee whose last blood sampling and analysis indicated a blood lead level at or above 40 microgram / 100 g of whole blood. This frequency shall continue until two consecutive blood samples and analyses indicated a blood lead level below 40 microgram / 100 g of whole blood; and

— At least monthly during the removal period of each employee removed from exposure to lead due to an elevated blood lead level;.

5.9.5 Whenever the results of a blood lead level test indicate that an employee's blood lead level exceeds the numerical criterion for medical removal under subparagraph 5.10.1.1, the employer shall provide a second (follow-up) blood sampling test within two weeks after the employer receives the results of the first blood sampling test.

5.9.6 Blood lead level sampling and analysis shall have an accuracy (to a confidence level of 95 percent) within ± 15 percent or 6 microgram /100 ml, whichever is greater, and shall be conducted by a laboratory licensed by the Kingdom or which has received as satisfactory grade in blood lead proficiency testing in the prior twelve months.

5.9.7 Within five working days after the receipt of biological monitoring results, the employer shall notify in writing each employee whose blood lead level exceeds 40 microgram / 100 g; (A) of that employee's blood lead level and (B) that the standard requires temporary medical removal with medical removal protection benefits when an employee's blood lead level exceeds the numerical criterion for medical removal under subparagraph 5.10.1.1.

5.9.8 The employer shall make available medical examinations and consultations to each employee covered under subparagraph 5.9.1 on the following schedule:

5.9.8.1 At least annually for each employee for whom a blood sampling test conducted at any time during the preceding 12 months indicated a blood lead level at or above 40 microgram/100 g;

5.9.8.2 Prior to assignment for each employee being assigned for the first time to an area in which airborne concentrations of lead are at or above the action level;

5.9.8.3 As soon as possible, upon notification by an employee either that the employee has developed signs or symptoms commonly; associated with lead intoxication, that the employee desires medical advice concerning the effects of current or past exposure to lead on the employee's ability to pro-create a healthy child, or that the employee has demonstrated difficulty in breathing during a respirator fitting test or during use, and

5.9.8.4 As medical appropriate for each employee either removed from exposure to lead due to a risk of sustaining material impairment to health, or otherwise limited pursuant to a final medical determination.

5.9.9 Medical examinations made available pursuant to subparagraphs 5.9.8.1 and 5.9.8.2 shall include the following elements:

— A detailed work history and a medical history, with particular attention to past lead exposure (occupational and non-occupation), personal habits (smoking, hygiene), and past gastrointestinal, hematologic, renal, cardiovascular, reproductive and neurological problems;

— A thorough physical examination, with particular attention to teeth, gums, hematologic, gastrointestinal, renal, cardiovascular, and neurological systems. Pulmonary status should be evaluated if respiratory protected will be used;

— A blood pressure measurement;

— A blood sample and analysis which determines:

– Blood lead level;

– Hemoglobin and hematocrit determinations, red cell indices, and examination of peripheral sear morphology;

– Blood urea nitrogen, and

– Serum creatinine;

– A routine urinalysis with microscopic examination; and

– Any laboratory or other test which the examining physician deems necessary by sound medical practice.

– The content of medical examinations made available pursuant to subparagraph 5.9.8.3 and 5.9.8.4 shall be determined by examining physician and, if requested by an employee, shall include pregnancy testing or laboratory evaluation of make fertility;

5.9.10 Information provided to examining and consulting physician

5.9.10.1 The employer shall provide an initial physician conducting a medical examination or consultation with the following information:

A copy of this regulation for inorganic lead including all appendices;

A description of the affected employee's duties as they relate to the employee's exposure;

The employee's exposure level or anticipated exposure level to lead and to any other toxic substance (if applicable);

A description of any personal protective equipment used or to be used;

Prior blood lead determinations; and

All prior written medical opinions concerning the employee in the employer's possession or control.

5.9.10.2 The employer shall provide the foregoing information to a second or third physician conducting a medical examination or consultation upon request either by the second or third physician, or by the employee.

5.9.11 Written Medical Opinions

5.9.11.1 The employer shall obtain and furnish an employee with a copy of a written medical opinion form each examining or consulting physician which contains the following information:

— The physician's opinion as to whether the employee has any detected medical condition which would place the employee at increase risk or material inpairment of the employee's health from exposure to lead;

— Any recommended special protective measure to be provided to the employee, or limitations to be placed upon the employee's exposure to lead;

— Any recommended limitation upon the employee's use of respirations, including a determination of whether the employee can wear a powered air purifying respirator if a physician determines that the employee cannot wear a negative pressure respirator; and

— The results of the blood lead determinations.

5.9.12 The employer shall instruct each examining and consulting physician to:

— Not reveal either in the written opinion, or in any other means of communication with the employer, findings, including laboratory results, or diagnoses unrelated to an employee's occupational exposure to lead; and

— Advise the employee of any medical condition, occupational or non-occupational, which dictates further medical examination or treatment.

5.9.12 The employer and an employee or authorized employee representative may agree upon the use of any expeditious alternate physician determination mechanism in lieu of the multiple physician review mechanism so long as the alternate mechanism otherwise satisfies the requirements.

5.9.13 The employer shall assure that any person whom he retains, employs, supervise or controls does not engage in prophylactic chelation of any employee at any time. If therapeutic or diagnostic chelation is to be performed by any person, the employer shall assure that it be done under the supervision of a licensed physician in a clinical setting with thorough and appropriate medical monitoring and that the employee is notified in writing prior to its occurrence.

5.10 Medical Removal protection

5.10.1 Temporary medical removal and return of an employee

5.10.1.1 Temporary removal due to elevated blood lead levels

5.10.1.1.1 During the first year following the effective date of the standard, the employer shall remove an employee from work having a daily 8-hour TWA exposure to lead at or above 100 microgram/cu m on each occasion that a periodic and a follow up blood sampling test conducted pursuant to this subparagraph indicate that the employee's blood lead level is at or above 80 microgram/100 g of whole blood.

5.10.1.1.2 During the second year following the effective date of the standard, the employer shall remove an employee from work having a daily 8-hour TWA exposure to lead at or above 50 microgram/cu m on each occasion that a periodic and a follow-up blood sampling test conducted pursuant to this subparagraph indicate that the employee's blood lead level is at or above 70 microgram / 100 g of whole blood.

5.10.1.1.3 Beginning with the third year following the effective date of the standard, the employer shall remove an employee from work having an exposure to

lead at or above the action level on each occasion that a periodic and a follow-up blood sampling test conducted pursuant to this subparagraph indicate that the employee's blood lead level is at or above 60 microgram /100 g of whole blood, and

5.10.1.1.4 Beginning with the fifth year following the effective date of this standard, the employee shall remove an employee from work having an exposure to lead at or above the action level on each occasion that the average of the last 3 blood sampling tests conducted pursuant to this subparagraph (or the average of the blood sampling tests conducted over the previous 6 months, whichever is longer) indicates that the employee's blood lead level is at or above3 50 microgram/100 g of whole blood; provided, however, that an employee need not be removed if the last blood sampling test indicates a blood lead level at or below 40 microgram/100 g of whole blood.

5.10.1.2 Temporary Removal Due to a Final Medical Determination

5.10.1.2.1 The employer shall remove an employee from work having an exposure to lead at or above the action level on each occasion that a final medical determination results in a medical finding, determination, or opinion that the employee has a detected medical condition which places the employee at increased risk of material impairment to health from exposure to lead;

5.10.1.2.2 The phrase "Final medical determination" shall mean the outcome of the multiple physical review mechanism or alternate medical determination mechanism used pursuant to the medical surveillance provisions.

5.10.1.2.3 Where a final medical determination results in any recommended special protective measure for an employee, or limitations on an employee's exposure to lead, the employer shall implement and act consistent with the recommendation.

5.10.1.3 Return to the employee to former job status

5.10.1.3.1 The employer shall return an employee to his or her former job status:

— For an employee remove dur to a blood lead level at or above 80 microgram/100 g, when two consecutive blood sampling tests indicate that the employee's blood lead level is at or below 60 microgram/100 g of whole blood;

— For an employee removed due to a blood lead level at or above 70 microgram /100 g, when two consecutive blood sampling tests indicate that the employee's blood lead level is at or below 50 microgram /100 g of whole blood.

— For an employee removed due to a blood lead level at or above 60 microgram / 100 g, or due to an average blood lead level at or above 50 microgram /100 g, when two consecutive blood sampling tests indicate that the employee's blood lead level is at or below 40 microgram / 100 g of whole blood.

— For an employee removed due to a final medical determination, when a subsequent final medical determination results in a medical finding,

determination, or opinion that the employee no longer has a detected medical condition which places the employee at increased risk or material impairment to health from exposure to lead; and

5.10.1.3.2 For the purpose of this paragraph, the requirement that an employer return an employee to his or her former job status is not intended to expand upon or restrict any rights an employee has or would have had, absent temporary medical removal, to a specific job classification or position under the terms of a collective bargaining agreement.

5.10.1.4 The employer shall remove any limitations placed on an employee or end any special protective measures provided to an employee pursuant to a final medical determination when a subsequent final medical determination indicates that the limitations or special protective measures are no longer necessary.

5.10.1.5 Employer Options Pending a Final Medical Determination. Where the multiple physician review mechanism, or alternate medical determination mechanism used pursuant to the medical surveillance provisions has not yet resulted in a final medical determination with respect to an employee, the employer shall act as follows:

— The employer may remove the employee from exposure to lead, provide special protective measure to the employee, or place limitations upon the employee, consistent with the medical findings, determinations, or recommendations of any of the physicians who have reviewed the employee's health status.

— The employer may return the employee to his or her former job status, end any special protective measures provided to the employee, and remove any limitation placed upon the employee, consistent with the medical findings, determinations, or recommendations of any of the physicians who have reviewed the employee's health status, with two exceptions. If ill the initial removal, special protection, or limitation of the employee resulted from a final medical determination which differed from the findings, determinations, or recommendations of the initial physician;

— The employee has been on removal status for the proceeding 18 months due to an elevated blood lead level, then the employer shall await a final medical determination.

5.10.2 Medical removal protection benefits

5.10.2.1 The employer shall provide to an employee up to 18 months of medical removal protection benefits on each occasion that an employee is removed from exposure to lead or otherwise limited.

5.10.2.2 For the purpose of this paragraph, the requirement that an employer provide medical removal protection benefits means that the employer shall maintain the earnings, seniority and other employee as though the employee had not been removed from normal exposure to lead or otherwise limited.

5.10.2.3 During the period of time that an employee is removed form normal exposure to lead or otherwise limited, the employer may condition the provision of medical removal protection benefits upon the employee's participation in follow-up medical surveillance made available.

5.10.2.4 If a removed employee files a claim for social insurance payments for a lead-related disability, then the employer shall continue to provide medical removal protection benefits pending disposition of the claim. To the extent that an award is made to the employee for earnings lost during the period of removal, the employer's medical removal protection obligation shall be reduced by such amount. The employer shall receive no credit for social insurance payments received by the employee for treatment related expenses.

5.10.2.5 The employer's obligation to provide medical removal protection benefits to a removed employee shall be reduced to the extent that the employee receives compensation for earnings lost during the period of removal either from a publicly or employer-funded compensation program, or from employment with another employer made possible by virtue of the employee's removal .

5.10.2.6 The employer shall take the following measures with respect to any employee removed from exposure to lead due to an elevated blood lead level whose blood lead level has not declined within the past 18 months of removal so that the employee has bee returned to his former job status:

— The employer shall make available to the employee a medical examination to obtain a final medical determination with respect to the employee;

— The employer shall assure that the final medical determination obtained indicates whether or not the employee may be returned to his former job status, and if not, what steps should be taken to protect the employee's health;

— Where the final medical determination has not yet been obtained, or once obtained indicates that the employee may not yet be returned to his former job status, the employer shall continue to provide medical removal protection benefits to the employee until either the employee is returned to former job status, or a final medical determination is made that the employee is incapable of ever safely returning to his former job status.

— Where the employer acts pursuant to a final medical determination which permits the return of the employee to his former job status despite what would otherwise be an unacceptable blood lead level, later questions concerning removing the employee again shall be decided by a final medical determination. The employer need not automatically remove such an employee pursuant to the blood lead level removal criteria.

5.10.2.7 Where an employer, although not required to do so, removes an employee from exposure to lead or otherwise place limitations on an employee due to

the effects of lead exposure on the employee's medical condition, the employer shall provide medical removal protection benefits to the employee equal to that required by subparagraph 5.10.2.1.

5.11 Employee information and training

5.11.1 Training programs

5.11.1.1 Each employer who has a workplace in which there is a potential exposure to airborne lead at any level shall inform employees of the content of Appendices A and B of this regulation.

5.11.1.2 The employer shall institute a training program for and assure the participation of all employees who are subject to exposure to lead at or above the action level or for whom the possibility of skin or eye irritation exists.

5.11.1.3 The employer shall provide initial training by 180 days from the effective date for those employees covered by subparagraph 5.11.1.2 on the standard's effective date and prior to the time of initial job assignment for those employees subsequently covered by this subparagraph.

5.11.1.4 The training program shall be repeated at least annually for each employee.

5.11.1.5 The employer shall assure that each employee is informed of the following:

— The content of this standard and its appendices;

— The specific nature of the operations which could result in exposure to lead above the action level;

— The purpose, proper selection, fitting, use, and limitations of respirators;

— The purpose and a description of the medical surveillance program, and the medical removal protection program including information concerning the adverse health effects associated with excessive exposure to lead (with particular attention to the adverse reproductive effects on both males and females);

— The engineering controls and work practices associated with the employee's job assignment;

— The contents of any compliance plan in effect; and

— Instructions to employees that chelating agents should not routinely be used to remove lead from their bodies and should be used at all except under the direction of a licensed physician.

5.11.2 Access to information and training materials

5.11.2.1 The employer shall make readily available to all affected employees a copy of this standard and its appendices.

5.11.2.2 The employer shall provide, upon request, all materials relating to the employee information and training program to the concerned authorities.

5.12 Record keeping

5.12.1 The employer shall establish and maintain an accurate recorded of all monitoring required in subparagraph 5.4.

5.12.2 This record shall include:

— The date(s), number, duration, location and results of each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure where applicable;

— A description of the sampling and analytical methods used and evidence of their accuracy;

— The type of respiratory protective devices worn, if any;

— Name and job classification of the employee monitored and of all other employee whose exposure the measurement is intended to represent; and

— The environmental variables that could affect the measurement of employee exposure.

5.12.3 The employer shall maintain these monitoring records for at least 40 years or for the duration of employment plus 20 years, whichever is longer.

5.12.4 The employer shall establish and maintain an accurate record for each employee subject to medical surveillance as required by subparagraph 5.9.

5.12.5 This record shall include:

— The name, number, and description of the duties of the employee;

— A copy of the physician's written opinions;

— Results of any airborne exposure monitoring done for that employee and the representative exposure level supplied to the physician; and

— Any employee medical complaints related to exposure to lead.

5.12.6 The employer shall keep, or assure that the examining physician keeps, the following medical records;

— A copy of the medical examination results including medical and work history required under subparagraph 5.9.

— A copy of the medical examination results including medical and work history required under subparagraph 5.9.

— A description of the laboratory procedures and a copy of any standards or guidelines used to interpret the test results or references to that information;

— A copy of the results of biological monitoring.

5.12.7 The employer shall maintain or assure that the physician maintains those medical records for at least 40 years, or for the duration of employment plus 20 years, whichever is longer.

5.12.8 The employer shall establish and maintain an accurate record for each employee removed from current exposure to lead pursuant to subparagraph 5.10.

5.12.9 Each record shall include.

— The name of the employee:

— The date on each occasion that the employee was removed from current exposure to lead as well as the corresponding date on which the employee was returned to his or her former job status;

— A brief explanation of how each removal was or is being accomplished; and

— A statement with respect to each removal indicating whether or not the reason for the removal as an elevated blood level.

5.12.10 The employer shall maintain each medical removal record for at least the duration of an employer's employment.

5.12.11 The employer shall make available upon request all records required to be maintained by concerned authorities for examination and copying.

5.12.12 Upon request, the employer shall make environmental monitoring, biological monitoring, and medical removal records available to affected employees, former employees or their authorized employee representatives. For inspection and copying.

5.12.13 Upon request, the employer shall make an employee's medical records required available to the affected employee or former employee or to a physician or other individual designated by such affected employee or former employees for examination and copying.

5.12.14 Whenever the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by subparagraph 5.12.

5.12.15 Whenever the employer ceases to do business and there is no successor employer to receive and retain the records required to be maintained for the prescribed period, these records shall be transmitted to concerned authorities.

5.12.16 At the expiration of the retention period for the records required to be maintained, the employer shall notify concerned authorities at least 3 months prior to the disposal of such records and shall transmit those records to concerned authorities if requested within the period.

5.13 **Observation of Monitoring**

5.13.1 The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to lead conducted pursuant to subparagraph 5.4.

5.13.2 Whenever observation of the monitoring of employee exposure to lead requires entry into an area where the use of respirators, protective clothing or equipment is required, the employer shall provide the observer with and assure the use of such respirators, clothing and equipment, and shall require the observer to comply with all other applicable safety and health procedures.

5.13.3 Without interfering with the monitoring, observers shall be entitled to:

— Receive an explanation of the measurement procedures;

— Observe all steps related to the monitoring of lead performed at the place of exposure; and

— Record the results obtained or receive copies of the results when returned by the laboratory.

5.14 Appendices. The information contained in the appendices to this paragraph is not intended by itself, to create any additional obligations not otherwise imposed by this standard nor detract from any existing obligation.

5.15 Startup dates. All obligations of this standard commence on the effective date except as follows:

5.15.1 The initial determination under subparagraph 5.4.3 shall be made as soon as possible but no later than 90 days from the effective date.

5.15.2 Initial determination under subparagraph 5.4.3 shall be completed as soon as possible but no later than 90 days from the effective date.

5.15.3 Initial biological monitoring and medical examinations under subpara-graph 5.9 shall be completed as soon as possible but not later than 180 days from the effective date priority for biological monitoring and medical examinations shall be given to employees whom the employer believes to be at greatest risk from continued exposure.

— Initial training and education shall be completed as soon as possible but not later than 180 days from the effective date.

— Respiratory protection required by subparagraph 5.6 shall be provided as soon as possible but not later than the following schedule.

— Employees whose 8-hour TWA exposure exceeds the PEL but is less the 200 micrograms/cu m – 150 days from the effective date.

— Employees whose 8-hour TWA exposure exceed the PEL but is less than 200 micrograms/cu m – 150 days from the effective date.

— Powered, air-purifying respirators provided under subparagraph 5.6.2.2 – 210 days from the effective date.

Appendix A

Substance Data Sheet for Occupational Exposure to Lead

1. Substance Identification

A. Substance. Pure lead (Pb) is a heavy metal at room temperature and pressure and is a basic chemical element. It can combine with various other substances to form numerous lead compounds.

B. Uses. Exposure to lead occurs in at least 120 different occupations, including primary and secondary lead smelting, lad storage battery manufacturing, lead pigment manufacturing and use, solder manu-facturing and use, shipbuilding and ship repairing, auto manufacturing, and printing.

2. Health Hazard Data

A. Ways in which lead enters a body. When absorbed into a body in certain doses leas is a toxic substance. The object of the lead standard is to prevent absorption of harmful quantities of lead. The standard is intended to protect an employee not only from the immediate toxic effects of lead, but also from the serious toxic effects that may not become apparent until years of exposure have passed.

— Lead can be absorbed into a body by inhalation (breathing) and ingestion (eating). Lead (except for certain organic lead compounds not covered by the standard, such as tetraethyl lead) is not absorbed through skin. When lead is scattered in the air as a dust, fume or mist it an be inhaled and absorbed through lungs and upper respiratory tract. Inhalation of airborne lead is generally the most important source of occupational lead absorption. One can also absorb lead through the digestive system if lead gets into the mouth and is swalled. If you handle food, cigarettes, chewing tobacco, or make-up which have lead on them or handle them with hands contaminated with lead, this will contribute to ingestion.

— A significant portion of the lead that can be inhaled or ingested gets into the blood stream. Once in the blood stream, lead is circulated throughout the body and stored in various organs and body tissues. Some of this lead is quickly filtered out of the body and excreted, but some remains in the blood and other tissues. As exposure to lead continues, the amount stored in the body will increase if absorbing more lead than the body is excreting. Even though an employee may not be aware of any immediate symptoms of disease, this lead stored in your tissues can be slowly causing irreversible damage, first to individual cells, then to the organs and whole body systems.

B. Effects of overexposure to lead

1) Short term (acute) overexposure. Lead is a potent, systemic poison that serves no known useful function once absorbed by the body. Taken in large enough doses, lead can kill in a matter of days. A condition affecting the brain called acute encephalopathy6 may arise which develops quickly to seizures, coma, and death from cardio respiratory arrest. A short term dose of lead can lead to acute encephalopathy. Short term occupational exposure s of this magnitude are highly unusual, but not impossible. Similar forms of encephalopathy may, however, arise from extended, chronic exposure to lower does of lead. There is no sharp dividing line between rapidly developing acute effects of lead, and chronic effects which take longer to acquire. Lead adversely affects numerous body systems, and causes forms of health impairment and disease which arise after periods of exposure as short as days or as long as several years.

2. Long term (chronic) overexposure. Chronic overexposure to lead may result in severe damage to the blood-forming, nerous, urinary and reproductive systems, Some common symptoms of chronic overexposure include loss of appetite, metallic taste in the mouth, anxiety, constipation, nausea, pallor, excessive tiredness, weakness, insomnia, headache, nervous irritability, muscle and joint pain or soreness fine-tremors, numbness, dizziness, hyperactivity and colic. In lead colic there may be severe abdominal pain.

– Damage to the central nervous system in general and the brain (encephalopathy) in particular is one of the most severe forms of lead poisoning. The most severe, often fatal, form of encephalopathy may be preceded by vomiting, a feeling of dullness progressing to drowsiness and stupor, poor memory, restlessness, irritability, tremor, and convulsions. It may arise suddenly with the onset of seizures, followed by coma, and death. There is a tendency for muscular weakness to develop at the same time. This weakness may progress to paralysis often observed as a characteristic “Wrist drops” or “Foot drop’ and is a manifestation of a disease to the nervous system called peripheral neuropathy.

– Chronic overexposure to lead also results in kidney disease with few, if any, symptoms appearing until extensive and most likely permanent kidney damage has occurred. Routine laboratory tests reveal the presence of this kidney disease only after about two-thirds of kidney function is lost. When over symptoms of urinary dysfunction arise, if is often too late to correct or prevent worsening conditions, and progression to kidney dialysis or death is possible.

– Chronic overexposure to lead impairs the reproductive systems of both men and women. Overexposure to lead may result in decreased sex drive, impotence and sterility in men. Lead can alter the structure of sperm cells raising the risk of birth defects. There is evidence of miscarriage and stillbirth in women whose husbands

were exposed to lead or who were exposed to lead themselves. Lead exposure also may result in decreased fertility, and abnormal menstrual cycles in women. The course of placental barrier and poses risks to developing fetuses. Children born of parents either one of whom were exposed to excess lead levels are more likely to have birth defects, mental retardation, behavioral disorders or die during the first year of childhood.

– Overexposure to lead also disrupts the blood-forming system resulting in decreased hemoglobin (the substance in the blood that carries oxygen to the cells) and ultimately anemia. Anemia is characterized by weakness, pallor and fatigability as a result of decreased oxygen carrying capacity in the blood.

3) Health protection goals of the standard. Prevention of adverse health effects for most workers from exposure to lead throughout a working lifetime requires that worker blood lead (PbB) levels be maintained at or below 40 micrograms/100 grams of whole blood. The blood lead levels of workers (both male and female workers) who intend to have children should be maintained below 30 micrograms/100 grams to minimize adverse reproductive health effects to the partents and to the developing fetus.

– The measurement of the blood lead level is the most useful indicator of the amount of lead being absorbed by the body. Blood lead levels (PbB) are most often reported in units of milligrams or micrograms of lead/100 milliliters (100 ml) or deciliter (dl) of blood. These three units are essentially the same.

– PbB measurement show the amount of lead-circulating in the blood stream, but do not give any information about the amount of lead stored in the various tissue. PbB measurements merely shown current absorption of lead, not the effect that lead is having on the body or the effects that past lead exposure may have already caused. Past research into lead-related diseases, however, has focused heavily on associations between PbBs and various diseases. As a result, the PbB is an important indicator of the likelihood that you will gradually acquire a lead-related health impairment or disease.

– Once the blood lead level climbs above 40 micrograms/100 grams, the risk of disease increases. There is a wide variability of individual response to lead, thus it is difficult to say that a particular PbB in a given person will cause a particular effect. Studies have associated fatal encephalopathy with PbB as low as 150 micrograms/100 grams. Other studies have shown other forms of diseases in some workers with PbBs well below 80 micrograms/100 grams. The PbB is a crucial indicator of the risks to health, but one other factor is also extremely important. This factor is the length of time a body has had elevated PbBs. The longer is body has had an elevated PbB, the greater the risk that

large quantities of lead are being gradually stored in the organs and tissues (body burden). The greater the overall body burden, the greater the chanves of substantial permanent damage.

– The best way to prevent all forms of lead-related impairments and diseases, both short term and long term, is to maintain the PbB below 40 micrograms/100 grams. The provisions of the standard are designed with this end in mind. The employer has prime responsibility to assure that the provisions of the standard are complied with both by the company and by individual workers. The worker, however, also has a responsibility to assist the employer in complying with the standard. The employee can play a key role in protecting his own health by learning about the lead hazards and their control, learning what the standard requires, following the standard where it governs his own actions, and seeing that the employer complies with provision governing his actions.

4) Reporting signs and symptoms of health problems. The employee should immediately notify the employer if the develops signs or symptoms associated with lead poisoning or if the desires medial advice concerning the effects of current or past exposure to lead on his ability to have a healthy child . The employee should also notify the employer if the had difficulty breathing during a respirator fit test or while wearing a respirator. In each of these cases the employer must make available appropriate medical examination or consultations. These must be provided at no cost to the employee and at a reasonable time and place.

Appendix B

Employee Standard Summary

1. Permissible Exposure Limit (PEL)

The standards sets a permissible exposure Limit (PEL) of 50 micrograms of lead/cu m of air averaged over an 8 hr workday. This is the highest level of lead in air to which a person may be permissibly exposed over an 8 hr workday. Since it is an 8 hr average it permits short exposures above the PEL so long as for each 8 hr workday the average exposure does not exceed the PEL.

This standard recognizes that the daily exposure to lead can extend beyond a typical 8 hr workday as the result of overtime or other alterations in the work schedule. To deal with this, the standard contains a formula which reduced the permissible exposure when exposed more than 8 hrs. For example, if exposed to lead for 10 hrs a day, the maximum permitted average exposure would be 40 micrograms/cu m.

2. Exposure Monitoring

If lead is present in the workplace in any quantity, the employer is required to make an initial determination of whether the action level is exceeded for any employee. This initial determination must include instrument monitoring of the air for the presence of lead and must cover the exposure of a representative number of employees who are reasonably believed to have the highest exposure levels. If the employer has conducted appropriate air sampling for lead in the past year he may use these results. If there have been any employee complaints of symptoms which may be attributable to exposure to lead or if there is any other information or observations which would indicate employee exposure to lead, this must also be considered as part of the initial determination. If this initial determination shows that a reasonable possibility exists that any employee may be exposed, without regard to respirators, over the action level (30 micrograms/cu m) the employer must set up an air monitoring program to determine the exposure level of every employee exposed to lead at the workplace.

In carrying out this air monitoring program, the employer is not required to monitor the exposure of every employee, but he must monitor a representative number of employees and job types. Enough sampling must be done to enable each employee's exposure level to be reasonably represented by at least one full shift (at least 7 hrs) air sample. In addition, these air samples and be taken under conditions which represent each employee's regular, daily exposure to lead.

If an employee is exposed to lead and air sampling is performed, the employer is required to quickly notify an employee in writing of air monitoring results which represent the exposure. If the results indicate the exposure exceed the PEL(without regard to the use of respirators), then the employer must also notify the employee of this in writing, and provide him with a description of the corrective action that will be taken to reduce the exposure.

The exposure must be rechecked by monitoring every 6 months if the exposure is over the action level but below the PEL. Air monitoring must be repeated every 3 months if exposed over the PEL. The employer may discontinue monitoring if 2 consecutive measurements, taken at least 2 weeks apart, are below the action level. However,

whenever there is a production, process, control, or personnel change at the workplace which may result in new or additional exposure to lead, or whenever there is any other reason to suspect a change which may result in new or additional exposure to lead, the employer must perform additional monitoring.

3. Methods of compliance

The employer is required to assure that no employee is exposed to lead in excess of the PEL. The standard establishes a priority of methods to be used to meet the PEL. The employer may meet the PEL by requiring the employee to wear respirators. Alternatively, the employer may choose to implement engineering and work practice controls.

4. Respiratory protection

The employer is required to provide and assure the use of respirators when the exposure to lead is not controlled below the PEL by other means. The employer must pay the cost of the respirator. Whenever requested the employer is also required to provide a respirator even if the air exposure level does not exceed the PEL. The employee might desire a respirator when, for example, he has received medical advice that his lead absorption should be decreased. Or, he may intend to have children in the near future, and want to reduce the level of lead in his body to minimize adverse reproductive effects. While respirators are the least satisfactory means of controlling the exposure, they are capable of providing significant protection if properly chosen, fitted, worn, cleaned, maintained, and replaced when they stop providing adequate protection.

The employer is required to select respirators from the 7 types listed in Table 2 of the respiratory protection section of the standard. Any respiratory chosen must be approved by GS. This respirator selection table will enable the employer to choose a type of respirator which will give the employee a proper amount of protection based on your airborne lead exposure. The employer may select a type of respirator that provides greater protection than that required by the standard, that is, one recommended for a higher concentration of lead than is present in your workplace. For example, a powered air purifying respirator (PAPR) is much more protective than a typical negative pressure respirator, and may also be more comfortable to wear. APAPR has a filter, cartridge or canister to clean the air, and a power source which continuously blows filtered air into your breathing zone. The employer might make a PAPR available to ease the burden of having to wear a respirator for long periods of time.

The employer must also start a respiratory protection program. This program must include written procedures for the proper selection, use, cleaning, storage, and maintenance of respirators.

The employer must assure that the respiratory face-piece fits properly. Proper fit of a respirator face-piece is critical. Obtaining a proper fit on each employee may require the employer to make available 2 or 3 different mask types. In order to assure that the respirator fits properly and that face-piece leakages is minimized. The employer must give the employee a “Quantitative fit test” if a negative pressure respirator is to be used. Any respirator which has a filter, cartridge or canister which cleans the work room air before breathing it and which requires the force of inhalation to draw air thru the filtering element is a negative pressure respirator. A positive pressure respirator supplies

air directly. A quantitative fits test uses a sophisticated machine to measure the amount, if any, of test material that leaks into the face-piece of the respirator.

The employee must also receive from the employer proper training in the use of respirators. The employer is required to teach the employee how to wear a respirator, to know why it is needed, and to understand its limitations.

The employer must test the effectiveness of the negative pressure respirator initially and at least very 6 months thereafter with a "Qualitative fit test". In this test, the fit of the face-piece is checked by seeing if a wearer can smell a substance placed outside the respiratory. If he can, there is appreciable leakage where the face piece meets the face.

The standard provide that if the respirator uses filter elements, the wearer must be given an opportunity to change the filter elements wherever an increase in breathing resistance is detected. The user also must be permitted to periodically leave the work area to wash his face and respirator facepiece whenever necessary to prevent skin irritation. IF the wearer ever has difficulty inbreathing during a fit test or while using a respirator, the employer must make a medical examination available to his to determine whether he can safely wear a respirator. The result of this examination may be to give the user a positive pressure respirator (which reduces breathing resistance) or to provide alternative means of protection.

5. Protective work clothing and equipment

If exposed to lead above the PEL, or if exposed to lead compounds such as lead arsenate or lead azide which can cause skin and eye irritation, the employer must provide protective work clothing and equipment appropriate for the hazard. If work clothing is provided, it must be provided in a clean and dry condition at least weekly, and daily if the airborne exposure to lead is greater than 200 micrograms/cu. m. Appropriate protective work clothing and equipment can include coveralls or similar full-body work clothing, gloves, hats, shoes or disposable shoes, coverlets, and face shields or vented goggles. The employer is required to provide all such equipment at no cost to the user. He is responsible for providing repairs and replacement as necessary, and also is responsible for the cleaning, laundering or disposal of protective clothing and equipment. Contaminated work exposure and expose the family since lead form the clothing can accumulate in the house, car, etc. Contaminated clothing which is to be cleaned, laundered or disposed of must be placed in closed containers in the change room. At no time lead may be removed form protective clothing or equipment by any means which disperses lead into the workroom air.

6. Housekeeping

The employer must establish a housekeeping program sufficient to maintain all surface as free as practicable of accumulations, of lead dust. Vacuuming is the preferred method of meeting this requirement, and the use of compressed air to clean floors and other surfaces is absolutely prohibited. Dry or wet sweeping, shoveling, or brushing may not be sued except where vacuuming or other equally effective methods have been tried and do not work. Vacuums must be used and emptied in a manner which minimizes the reentry of lead into the workplace.

7. Hygiene facilities and practices

The standard requires that change rooms and showers, be constructed and made available to workers exposed to lead above the PEL. Change rooms and showers, must be used by workers exposed in excess of the PEL. After showering, no clothing or equipment worn during the shift may be worn home, and this includes shoes and underwear. Personal clothing worn during the shift should be carried home and cleaned carefully so that it does not contaminate the home. Lunchrooms may not be entered with protective clothing or equipment unless surface dust as been removed by vacuuming, downdraft booth, or other cleaning method. Finally, workers exposed above the PEL must wash both their hands and faces prior to eating, drinking, smoking or applying cosmetics.

All of the facilities and hygiene practices just discusses dare essential to minimize additional sources of lead absorption from inhalation or ingestion of lead that may accumulate on an employee, his clothes, or his possessions. Strict compliance with these provisions can virtually eliminate several sources of lead exposure which significantly contribute to excessive lead absorption.

8. Medical surveillance

The medical surveillance program is part of the standard's comprehensive approach to the prevention of lead related disease. Its purpose is to supplement the main thrust of the standard which is aimed at minimizing airborne concentrations of lead and sources of ingestion. Only medical surveillance can determine if the other provisions of the standard have affectively most workers from the adverse effects of lead exposure, but may not be satisfactory to protect individual workers (1) who have high body burdens of lead acquired over past years, (2) who have additional, uncontrolled sources of non-occupational lead exposure, (3) who exhibit unusual variations in lead absorption rates, or (4) who have specific non-work related medical conditions which could be aggravated by lead exposure (e.g., renal disease, anemia). In addition, control systems may fail, or hygiene and respirator programs may be inadequate. Periodic medical surveillance of individual workers will help detect those failures. Medical surveillance will also be important to protect the reproductive ability.

All medical surveillance required by the standard must be performed by or under the supervision of a licensed physician. The employer must provide required medical surveillance without cost to employees and at a reasonable time and place. The standard's medical surveillance program has two parts-periodic biological monitoring and medical examinations.

The employer's obligation to offer medical surveillance is triggered by the results of the air monitoring program. Medical surveillance must be made available to all employees who are exposed in excess of the action level for more than 30 days a year. The initial phase of the medical surveillance program, which includes blood lead level tests and medical examinations, must be given to employees whom the employer believers to be at greatest risk from continued exposure (for example, those with the longest prior exposure to lead, or those with the highest current exposure). Thereafter, the employer must periodically make medical surveillance – both biological monitoring and medical examinations – available to all covered employees.

Biological monitoring under the standard consists of blood lead level (PbB) tests at least every 6 months after the initial PbB test. Biological monitoring under the standard is currently limited to PbB testing. If a worker's PbB exceeds 40 micrograms/100grams the monitoring frequency must be increased form every 6 months to at least every 2 months and not reduced until 2 consecutive PbBs indicate a blood lead level below 40 micrograms/100 grams, the employer must notify the employee of this in writing within 5 working days of his receipt of the test results. The employer must also inform the employee that the standard requires temporary medical removal with economic protection when his PbB exceeds certain criteria (See Discussion of Medical Removal Protection). During the first year of the standards, this removal criterion is 80 micrograms/100 grams. Anything PbB exceeds 80 micrograms/100 grams the employer must make available to the employee a prompt follow-up PbB test to ascertain the PbB. If the two tests both exceed 80 micrograms/100 grams and the employee is temporarily removed, then the employer must make successive PbB tests available to him on a monthly basis during the period of his removal.

Medical examination beyond the initial one must be made available on a n annual basis if the blood lead level exceed 40 micrograms/100 grams at any time during the preceding year. The initial examination will provide information to establish a baseline to which subsequent data can be compared. An initial medical examination must also be made available (prior to assignment) for each employee being assigned for the first time to an area where the airborne concentration of lead equals or exceeds the action level. In addition, a medical examination or consultation must be made available as soon as possible if the employee notifies employer that he is experiencing signs or symptoms commonly associated with lead poisoning or that he has difficulty breathing while wearing a respirator or during a respirator fit test. The worker must also be provided a medical examination or consultation if the employee notifies the employer that he desires medical advice concerning the effects of current or past exposure to lead on the ability to procreate a healthy child.

Finally, appropriate follow-up medical examinations or consultations may also be provided for employees who have been temporarily removed from exposure under the medical removal protection provisions of the standard.

The standard specifies the minimum content of pre-assignment and annual medical examinations. The content of other types medical examinations and consultations is left up to the sound discretion of the examining physician. Pre-assignment and annual medical examinations must include (1) a detailed work history and medical history, (2) a thorough physical examination, and (3) a series of laboratory tests designed to check the blood chemistry and the kidney function. In addition, at any time upon request, a laboratory evaluation of make fertility will be made (miscroscopic examination of a sperm sample), or a pregnancy test will be given.

The standard requires the employer to provide certain information to a physician to aid in his or her examination of the employee. This information includes (1) the standard and its appendices, (2) a description of the employee duties as they relate to lead exposure, (3) the employee exposure level, (4) a description of personal protective equipment to be worned, (5) prior blood lead level results, and (6) prior written medical opinions concerning the employee that the employer has. After a medical examination or consultation the physician must prepare a written report which must contain (1) the

physician's opinion as to whether the employee has any medical condition which places him at increased risk of material impairment to health from exposure to lead, (2) any recommended special protective measures to be provided to him, (3) any blood lead level determinations, and (4) any recommended limitation on the use of respirators. This last element must include a determination of whether he can wear a powered air purifying respirator (PAPR) if he is found unable to wear a negative pressure respirator.

The medical surveillance program of the lead standard may at some point in time serve to notify certain workers that they have acquired a disease or other adverse medical condition as a result of occupational lead exposure. If this is true, these workers might have legal rights to compensation from public agencies, their employers, firms that supply hazardous products to their employers, or other persons. It should be stressed that concerned authorities is in no way trying to either enourage or discourage claims or lawsuits. However, since results of the standard's medical surveillance program can significantly affect the legal remedies of a worker who has acquired a job-related disease or impairment, it is proper for concerned authorities to make him aware of this.

The medical surveillance section of the standard also contains provisions dealing with chelation. Chelation is the use of certain drugs (administered in pill form or injected into the body) to reduce the amount of lead absorbed in body tissues. Experience accumulated by the medical and scientific communities has largely confirmed the effectiveness of this type of therapy for the treatment of very severe lead poisoning. On the other hand, it has also been established that there can be a long list of extremely harmful side effects associated with the use of chelating agents. The medical community has balanced the advantages and disadvantages resulting from the use of cehlating agents in various circumstances and has established when the use of these agents is acceptable.

The standard includes these accepted limitations due to a history of abuse of chelation therapy by some lead companies. The most widely used chelating agents are calcium disodium EDTA, (CaNa2EDTA), Calcium Disodium Versenate (Versenate), and d-penicillaamine (Pencillamine or Cupramine).

The standard prohibits "Prophylactic chelation" of any employee by any person the employer retains, supervised or controls. "Prophylactic chelation" is the routine use of chelating or similarly acting drugs to prevent elevated blood levels in workers who are occupationally exposed to lead, or the use of the drugs to routinely lower blood lead levels to predesignated concentrations believed to be 'safe'. It should be emphasized that where an employer takes a work who has no symptoms of lead poisoning and has chelation carried out by a physician (either inside or outside of a hospital) solely to reduce the worker's blood lead level, that will generally be considered prophylactic chelation. The use of a hospital and a physician does not mean that prophylactic chelation is not being performed. Routine chelation to prevent increased or reduce current blood lead levels is unacceptable whatever the setting.

The standard allows the use of "Therapeutic" or "Diagnostic" chelation if administered under the superviosn of lincensed physician in a clinical setting with through and appropriate medical monitoring. Therapeutic chelation responds to severe lead poisoning where there are marked symptoms. Diagnostic chelation involved giving a patient a dose of the drug then collecting all urine excreted for some period of time as an aid to the diagnosis of lead poisoning.

In cases where the examining physician determines that chelation is appropriate, the employee must be notified in writing of this fact before such treatment. This will inform him of a potentially harmful treatment, and allow him to obtain a second opinion.

9. Medical Removal Protection

Excessive lead absorption subjects the employee to increased risk of disease. Medical removal protection (MRP) is a means of protecting the employee when, for whatever reasons, other methods, such as engineering controls, work practices, and respirators, have failed to provide the protection needed. MRP involves the temporary removal of a worker from his or her regular job to a place of significantly lower exposure without any loss of earnings, seniority, or other employment rights or benefits. The purpose of this program is to cease further lead absorption and allow the body to naturally excrete lead which has previously been absorbed. Temporary medical removal can result from an elevated blood lead level, or a medical opinion. Up to 18 months of protection is provided as a result of either form of removal. The vast majority of removed workers, however, will return to their former jobs long before this 18 months period expires. The standard contains special provisions to deal with the extraordinary but possible case where a long-term worker's blood lead level does not adequately decline during 18 months of removal.

During the first year of the standard, if the blood lead level is 80 micrograms/100 grams or above the worker must be removed form any exposure where the air lead level without a respirator would be 100 micrograms/cu m or above. If he is removed from his normal job he may not be returned until his blood lead level declines to at least 60 micrograms/100 grams. These criteria for removal and return will change according to the following schedule:

	Removal blood lead (microgram/100 grams)	Air lead (micrograms/cu m)	Return blood lead (micrograms/100 grams)
After March 1, 1981	70 and above	50 and above	At or below 50
After March 1, 1982	60 and above	30 and above	At or below 40
After March 1, 1984	50 and above	30 and above	At or below 40
Averaged over 6 months			

He may be removed from exposure even if his blood lead levels are below these criteria if a final medical determination indicates that he temporarily needs reduced lead exposure for medical reasons. If the physician who is implementing the employers medical program makes a final written opinion recommending the removal or other special protective measure, the employer must implement the physician's recommendation. If he is removed in this manner, he may only be retuned when the doctor indicates that it is safe for him to do so.

The standard does not give specific instructions dealing with what an employer must do with a removed worker. The job assignment upon removal is a matter for the employee, and the employer to work out consistent with existing procedures for job assignments. Each removal must be accomplished in a manner consistent with existing collective bargaining relationship. The employer is given broad discretion to implement temporary

removals so long as no attempt is made to override existing agreements. Similarly, a removed worker is provided no right to veto an employer's choice which satisfies the standard.

In most cases, employers will likely transfer removed employees to other jobs with sufficiently low lead exposure. Alternatively, a worker's hours may be reduced so that the time weighted average exposure is reduced, or he or she may be temporarily laid off if no other alternative is feasible.

In all of these situation, MRP benefits must be provided during the period of removal i.e. he continues to receive the same earning, seniority, and other right and benefits he would have had if he had not been removed. Earnings includes more than just the base wage; it includes overtime, shift differentials, incentives, and other compensation he would have earned if he had not been removed. During the period of removal he must also be provided with appropriate follow-up medical surveillance. If he were removed because his blood lead level was too high, he must be provided with a monthly blood test. If a medical opinion caused his removal, he must be provided medical tests or examinations that the doctor believes to be appropriate. If he does not participate in this follow up medical surveillance, he may lose your eligibility for MRP benefits.

When the worker is medically eligible to return to his former job, the employer must return him to his "Former job status". This means that he is entitled to the position, wages, benefits, etc., he would have had if he had not been removed. If he would still be in his old job if not removal had occurred that is where he goes back. If not, he is returned consistent with whatever job assignment discretion the employer would have had if not removal had occurred. MRP only seeks to maintain his rights, not expand them or diminish them.

If the worker is removed under MRP and he is also eligible for worer compensation or other compensation for lost wages, your employer's MRP benefits obligation is reduced by the amount that he actually receives from these other sources. This is also true if he obtains other employment during the time he is laid off with MRP benefits.

The standard also covers situations where an employer voluntarily removes a worker from exposure to lead due to the effects of lead on the employee's medical condition, even though the standard does not require removal. In these situations MRP benefits must still be provided as though the standard required removal. Finally, it is important to note that in all cases where removal is required, respirators cannot be used as a substitute. Respirators may be sued before removal becomes necessary, but not as an alternative to a transfer to a low exposure job, or to a lay-off with MRP benefits.

10. Employee information and training

The employer is required to provide an information and training program for all employees exposed to lead above the action level or who may suffer skin or eye irritation from lead. This program must inform these employee of the specific hazards associated with their work environment, protective measure which can be taken, the danger of lead to their bodies (including their reproductive systems), and their rights under the standard. In addition the employer must make readily available to all employees, including those exposed below the action level, a copy of the standard and its appendices and must distribute to all employees any materials provided to the employer by the concerned authorities.

All new employees must be trained prior to initial assignment to areas where there is a possibility of exposure over the action level.

This training program must also be provided at least annually thereafter.

11. Record keeping

The employer is required to keep all records of exposure monitoring for airborne lead. These records must include the name and job classification of employee measured, details of the sampling and analytic techniques, the results of this sampling, and the type of respiratory protection being worn by the person sampled, The employer is also required to keep all records of biological monitoring and medical examination results. These must include the names of the employees, the physician's written opinion, and a copy of the results of the examination. All of the above kinds of records must be kept for 40 hears, or for at least 20 years after the termination of employment, whichever is longer.

Record-keeping is also required if you are temporarily removed form the job under the medical removal protection program. This record must include name, the date of removal and return, how the removal was or is being accomplished, and whether or not the reason for the removal was an elevated blood lead level. The employer is required to keep each medical removal record only for as long as the duration of an employee's employment.

The standard requires that if an employee request to see or copy environmental monitoring, blood lead level monitoring, blood lead level monitoring, or medical removal records, they must be made available to him or to a representative that the authorizes. Medical records other than PbB's must also be provided upon request to the worker, to the physician or to any other person whom the worker may specifically designate.

12. Observations of monitoring

When air monitoring for lead is performed at the workplace, the employer must allow the worker or someone he designate to act as an observer of the monitoring. Observers are entitled to an explanation of the measurement procedure, and to record the results obtained. Since results will not normally be available at the time of the monitoring, observers are entitled to record or receive the results of the monitoring when retuned by the laboratory. The employer is required to provide the observer with any personal protective devices required to be worn by employees working in the area that is being monitored. The employer must require the observer to wear all such equipment and to comply with all other applicable safety and health procedures.

Appendix C

Medical Surveillance Guidelines

Introduction

The primary purpose to assure, so far as possible, safe and healthful working conditions for every working man and woman. The occupational health standard for inorganic lead was promulgated to protect workers exposed to inorganic lead including metallic lead, all inorganic lead compounds and organic lead soaps.

Occupational exposure to inorganic lead is to be limited to 50 micrograms/cu m based on a 8 hr time-weighted average (TWA). This level of exposure eventually must be achieved through a combination of engineering, work practice and other administrative controls. Periods of time ranging from 1 to 10 years are provided for different industries to implement these controls. The schedule which is based on individual industry considerations is given in Table 1. Until these controls are in place, respirators must be used to meet the 50 micrograms/cu m exposure limit.

The standard also provides for a program of biological monitoring and medical surveillance for all employees exposed to levels of inorganic lead above the action level of 30 micrograms/cu m (TWA) for more than 30 days/year.

The purpose of this document is to outline the medical surveillance provisions of the standard for inorganic lead, and to provide further information to the physician regarding the examination and evaluation of workers exposed to inorganic lead.

Section 1 provides a detailed description of the monitoring procedure including the required frequency of blood testing for exposed workers, provisions for medical removal protection (MRP), the recommended right of the employee to a second medical opinion, and notification and record keeping requirements of the employer. A discussion of the requirements for respirator use and respirator monitoring and concerned authorities position on prophlactic chelation therapy are also included in this section.

Section 2 discusses the toxic effects and clinical manifestations of lead poisoning and effects of lead intoxication on enzymatic pathways in heme synethesis. The adverse effects on both male and female reproductive capacity and on the fetus are also discussed.

Section 3 outlines the recommended medical evaluation of the worker exposed to inorganic lead including details of the medical history, physical examination, and recommended laboratory tests, which are based on the toxic effects of lead as discussed in Section 2.

Section 4 provides detailed information concerning the laboratory tests available for the monitoring of exposed workers. Included also is a discussion of the relative value of each test and the limitations and precautions which are necessary in the interpretation of the laboratory results.

Table 1

Permissible airborne lead levels by industry (micrograms/cu m)*	Effective Date					
	Mar. 1, 1980	Mar. 1, 1981	Mar. 1, 1982	Mar. 1, 1983	Mar. 1, 1985	Mar. 1, 1990 final
Primary lead production	200	200	200	100	50	50
Secondary lead production	200	200	200	100	50	50
Lead-acid battery manufacturing	200	200	100	100	50	50
Nonferrous foundries	200	100	100	100	50	50
Lead pigment manufacturing	200	200	200	100	50	50
All other industries	200	50	50	50	50	50

* Airborne levels to be achieved without reliance or respirator protection through a combination of engineering, work practice and other administrative controls. While these controls are being implemented respirators must be used to meet the 50 micrograms/cu m exposure limit

1. Medical surveillance and monitoring requirements for workers exposed to inorganic lead

A program of biological monitoring and medical surveillance is to be made available to all employees exposed to lead above the action level of 30 micrograms/cu m TWA for more than 30 days each year. This program consists of periodic blood sampling and medical evaluation to be performed on a schedule which is defined by previous laboratory results, worker complaints or concerns, and the clinical assessment of the examining physician.

Under this program, the blood lead level of all employees who are exposed to lead above the action lead of 30 micrograms/cu m is to be determined at least every 60 months. The frequency is increased to every 2 months for employees whose last blood lead level as between 40 microgram/100 grams whole blood and the level requiring employee medical removal to be discussed below. For employees who are removed from exposure to lead due to an elevated blood lead, a new blood lead level must be measured monthly. A zinc protoporphyrin (ZPP) measurement is strongly recommended on each occasion that a blood lead level measurement is made.

An annual medical examination and consultation performed under the guidelines discussed in Section 3 is to be made available to each employee for whom a blood test conducted at any time during the preceding 12 months indicated a blood lead level at or above 40 micrograms/100 grams. Also, an examination is to be given to al employees prior to their assignment to an area in which airborne lead concentrations reach or exceed the action level. In addition, a medical examination must be provided as soon as possible after notification by an employee that the employee has developed signs or symptoms commonly associated with lead intoxication, that the employee has developed signs or symptoms commonly associated with lead intoxication, that the employee desires medical advice regarding lead exposure and the ability to procreate a healthy child, or that the employee has demonstrated difficulty in breathing during a respirator

fitting test or during respirator use. An examination is also to be made available to each employee removed from exposure to lead due to a risk of sustaining material impairment to health, or otherwise limited or specially protected pursuant to medical recommendations.

Results of biological monitoring or the recommendations of an examining physician may necessitate removal of an employee from further lead exposure pursuant to the standard's medical removal protection (MRP) Program. The object of the MRP program is to provide temporary medical removal to workers either with substantially elevated blood lead levels or otherwise at risk of sustaining material health impairment form continued substantial exposure to lead. The following guidelines which are summarized in Table 2 were created under the standard for the temporary removal of an exposed employee and his or her sub sequent return to work in an exposure area.

Under the standard's ultimate worker removal criteria, a worker is to be removed from any work having any 8 hr TWA exposure to lead of 30 micrograms/cu m or more whenever either of the following circumstances apply: (1) a blood lead level of 60 micrograms/100 grams or greater is obtained and confirmed by a second follow-up blood lead level performed with 2 weeks after the employer receives the results of the first blood sampling test, or (2) the average of the previous 3 blood lead determinations or the average of all blood lead determinations conducted during the previous 6 months, whichever encompasses the longest time period, equals or exceed 50 micrograms/100 grams, unless the last blood sample indicates a blood lead level at or below 40 micrograms/100 grams in which case the employee need not be removed. Medical removal is to continue until 2 consecutive blood lead levels are 40 micrograms/100 grams or less.

During the first 2 years that the ultimate removal criteria are being phased in, the return criteria have been set to assure that a worker's blood lead level has substantially declined during the period of removal. From March 1, 1980 to March 1, 1981, the blood lead level requiring employee medical removal is 80 micrograms/100grams. Workers found to have confirmed blood lead at or above 100 micrograms/cu m. Workers so removed are to be retuned to work when their blood lead levels are at or below 60 micrograms/100 grams of whole blood. From March 1, 1981 to March 1. 1982, the blood lead level requiring medical removal is 70 micrograms/100 grams. During this period workers need only be removed from jobs having a daily 8 hr TWA exposure to lead at or above 50 micrograms/cu m and are to be retuned to work when a level of 50 micrograms/100 grams is achieved. Beginning March 1, 1982, return depends on a worker's blood lead level declining to 40 micrograms/100 grams of whole blood.

As part of the standard, the employee is required to notify in writing each employee whose blood lead level exceed 40 micrograms/100 grams. In addition each such employee is to be informed that the standard requires medical removal with MRP benefits, discussed below, when an employee's blood lead level exceeds the above defined limits.

In addition to the above blood lead level criteria, temporary worker removal may also take place as a result of medical determinations and recommendations. Written medical opinions must be prepared after each examination pursuant to the standard. If the examining physician includes a medial finding, determination or opinion that the employee has a medical condition which places the employee at increased risk of

material health impairment from exposure to lead, then the employee must be removed from exposure to lead at or above the action level. Alternatively, if the examining physician recommends special protective measures for an employee (e.g., use of a powered air purifying respirator) or recommends limitation on an employee's exposure to lead, then the employer must implement these recommendations. Recommendations may be more stringent than the specific provisions of the standard. The examining physician, therefore, is given broad flexibility to tailor special protective procedures to the needs of individual employees. This flexibility extends so the evaluation and management of pregnant workers and male and female workers who are planning to raise children. Based on the history, physical examination, and laboratory studies, the physician might recommend special protective measures or medical removal for an employee who is pregnant or who is planning to conceive a child when, in the physician's judgment, continued exposure to lead at the current job would pose a significant risk. The return of the employee to his or her former job status, or the removal of special protections or limitations, depends upon the examining physician determining that the employee is no longer at increases risk of material impairment or that special measures are o longer needed.

During the period of any form of special protection or removal, the employer must maintain the worker's earning, seniority, and other employment rights and benefits (as though the worker had not been removed) for a period of up to 18 months.; This economic protection will maximize meaningful worker participation in the medical surveillance program, and is appropriate as part of the employer's overall obligation to provide a safe and healthful workplace. The provisions of MRP benefits during the employer's removal period may, however, be continued upon participation in medical surveillance.

On rare occasions, an employee's blood lead level may not acceptably decline within 18 months of removal. This situation will arise only in unusual circumstances, thus the standard relies on an individual medical examination to determine how to protect such an employee. This medical determination is to be based on both laboratory values, including lead levels, zinc protoporphyrin levels, blood counts, and other tests felt to be warranted, as well as the physician's judgment that any symptoms or findings on physical examination are a result of lead toxicity. The medical determination may that the employee is incapable of ever safely returning to his or her former job status. The medical determination may provide additional removal time past 18 months for some employees or specify special protective measures to be implemented.

Table 2

Effective date

	Mar. 1. 1980	Mar. 1. 1981	Mar. 1. 1982	Mar. 1. 1983	Mar. 1. 1984
A Blood lead level requiring employee medical removal, (Level must be confirmed with second follow-up blood lead level within 2 weeks of first report).	≥ 80 micrograms /100 grams	≥ 70 micrograms /100 grams	≥ 60 micrograms /100 grams	≥ 60 micrograms /100 grams	≥ 60 micrograms /100 grams or average of last 3 blood samples or over previous 6 months (whichever is over a longer time period) is 50 micrograms/100 grams or greater than unless last blood sample is 40 micrograms/100 grams or less
B Frequency which employees exposed to action level of lead (30 micrograms/cu m TWA) must have blood lead level checked (ZPP is also strongly recommended in each occasion that a blood lead is obtained):					
1. Last blood lead level less than 40 micrograms/100 grams	Every 6 months	Every 6 months	Every 6 months	Every 6 months	Every 6 months
2. Last blood lead level between 40 micrograms/100 grams and level requiring medical removal (see A above)	Every 2 months	Every 2 months	Every 2 months	Every 2 months	Every 2 months
3. Employees removed from exposure to lead because of an elevated blood lead level.	Every 1 months	Every 1 months	Every 1 months	Every 1 months	Every 1 months
C. Permissible airborne exposure limit for workers removed from work due to an elevated blood leas level (without regard to respirator protection)	< 100 microgram/ cu m 8 hr TWA	< 50 microgram/ cu m 8 hr TWA	< 30 microgram/ cu m 8 hr TWA	< 30 microgram/ cu m 8 hr TWA	< 30 microgram/ cu m 8 hr TWA
D. Blood lead level conformed with a second blood analysis, at which employee may return to work. Permissible exposure without regard to respirator protection is listed by industry in Table 1.	≤ 60 microgram/ 100 grams	≤ 50 microgram/ 100 grams	≤ 40 microgram/ 100 grams	≤ 40 microgram/ 100 grams	≤ 40 microgram/ 100 grams

Note: When medical opinion indicates that an employee is at risk of material impairment from exposure to lead, the physician can remove an employee from exposures exceeding the action level (or less 0 or recommended special protective measure as deemed appropriate and necessary. Medical monitoring during the medical removal period can be more stringent than noted in the table above if the physician so specifies. Return to work or removal of limitations and special protections is permitted when the physician indicates that the worker is no longer at risk of material impairment.

The employer must provide examining and consulting physicians with the following specific information: a copy of the lead regulations and all appendices, a description of the employee's duties as related to exposure, the exposure level to lead and any other toxic substances (if applicable), a description of personal protective equipment used, blood lead levels, and all prior written medical opinions regarding the employee in the employer's possession or control. The employer must also obtain from the physician and provide the employee with a written medical opinion containing blood lead levels, the physician's opinion as t whether the employee is at risk of material impairment to health, any recommended protective measures for the employee if further exposure is permitted, as well as any recommended limitations upon an employee's use of respirators.

Employers must instruct each physician not to reveal to the employee in writing or in any other way his or her findings, laboratory result, or diagnoses which are felt to be unrelated to occupational lead exposure. The must also instruct each physician to advise the employee of any occupationally or non-occupationally related medical condition requiring further treatment or evaluation.

The standard provides for the use of respirators where engineering and other primary controls have not be fully implemented. However, the use of respirator protection shall not be used in lieu of temporary medical removed due to elevated blood lead levels or findings that an employee is at risk of material health impairment. This is based on the numberous inadequacies of respirators including skin rash where the facepiece makes contact with the skin, unacceptable stress to breathing in some workers with underlying cardiopulmonary impairment, difficulty in providing adequate fit, the tendency for respirators to create additional hazards by interfering with vision, hearing, and mobility, and the difficulties of assuring the maximum effectiveness of a complicated work practice program involving respirators. Respirators do, however, serve a useful function where engineering and work practice controls are inadequate by providing supplementary, interim, or short-term protection, provided they are properly selected for the environment in which the employee will be working, properly fitted to the employee, maintained and cleaned periodically, and worn by the employee when required.

In its final standard on occupational exposure to inorganic lead, concerned authorities has prohibited prophylactic chelation. Diagnostic and therapeutic chelation are permitted only under the supervision of a licensed physician with appropriate medical monitoring in a acceptable clinical setting. The decision to initiate chelation therapy must be made on an individual basis and take into account the severity of symptoms felt to be result of lead toxicity along with blood lead levels, ZPP levels, and other laboratory tests as appropriate. EDTA and penicillamine which are the primary chelating agents used in the therapy of occupational lead poisoning have significant potential side effects and their use must be justified on the basis of expected benefits to the worker. Unless frank and severe symptoms are present, therapeutic chelation is not recommended given the opportunity to remove a worker from exposure and allow the body to naturally excrete accumulated lead. As a diagnostic aide, the chelation mobilization test using CA-EDTA has limited applicability. According to some investigators, the test can differentiate between lead-induced and other nephro-pathies. The test may also provide an estimation of the mobile fraction of the total body lead burden.

Employers are required to assure that accurate records are maintained on exposure monitoring medical surveillance, and medical removal for each employee. Exposure monitoring and medical surveillance records must be kept for 40 years or the duration of employment plus 20 years, whichever is longer, while medical removal records must be maintained for the duration of employment. All records required under the standard must be available upon request to concerned authorities. Employers must also make environmental and biological monitoring and medical removal records available to affected employees and to former employees or their authorized employee representatives. Employees or their specifically designed representatives heave access to their entire medical surveillance records.

In addition, the standard requires that the employer inform all workers exposed to lead at or above the action level of the provisions of the standard and all its appendices, the purpose and description of medical surveillance and provision for medical removal protection if temporary removal is required. An understanding of the potential health effects of lead exposure by all exposed employees along with full understanding of their rights under the lead standard is essential for an effective monitoring program.

2. Adverse health effects of inorganic lead

Although the toxicity of lead has been known for 2000 years, the knowledge of the complex relationship between lead exposure and human response is still being refined. Significant research into the toxic properties of lead continues throughout the world, and it should be anticipated that our understanding of thresholds of effects and margins of safety will be improved in future years. The provisions of the lead standard are founded on 2 prime medical judgments: (1) the prevention of adverse health effects from exposure to lead throughout a working lifetime requires that worker blood lead levels be maintained at or below 40 micrograms/100 grams and (2) the blood lead levels of workers, male or female, who intend to parent in the near future should be maintained below 30 micrograms/100 grams to minimize adverse reproductive health effects to the parents and developing fetus. The adverse effects of lead on reproduction are being actively researched and concerned authorities encourage the physician to remain abreast of recent developments in the are to advise pregnant workers or workers planning to conceive children.

The spectrum of health effects caused by lead exposure can be subdivided into 5 developmental states: normal, physiological changes of uncertain significance, pathophysiological changes, overt symptoms (morbidity), and mortality. Within this process there are no sharp distinctions, but rather a continuum of effects. Boundaries between categories overlap due to the wide variation of individual responses and exposures in the working population.

A. Heme synthesis inhibition. The earliest demonstrated effect of lead involves its ability to inhibit at least 2 enzymes of the heme synthesis pathway at very low blood levels. Inhibition of delta-aminolevulinic acid dehydrase (ALA-D) which catalyzes the conversion of deltaaminolevulinic acid (ALA) to protoporphyrin is observed at a blood lead level below 20 micrograms/100 grams whole blood. At a blood lead level of 40 microgreams/100 grams, more than 20 percent of the population would have 70 percent inhibition of ALA-D. There is an exponential increase in ALA excretion at blood lead levels greater than 40 micrograms/100 grams.

Another enzyme, ferrochelatase, is also inhibited at low blood lead levels. Inhibition of ferrochelatase leads to increased free eythrocyte protoporphyrin (FEP) in the blood which can then bind to zinc to yield zinc protoporphyrin. At a blood level of 50 micrograms/100 grams or greater, nearly 100 percent of the population will have an increase in FEP. There is also an exponential relationship between blood lead levels greater than 40 micrograms/100 grams and the associated ZPP level, which has led to the development of ZPP screening test for lead exposure.

One of the eventual results of lead-induced inhibition of enzymes in the heme sytheisis pathway is anemia which can be asymptomatic if mild but associated with a wide array of symptoms including dizziness, fatigue, and tachycardia when more severe. Studies have indicated that leas level s as low as 50 micrograms/100 grams can be associated with a definite decreased hemoglobin, although most cases of lead-induced anemia, as well as shortened red-cell survival times, occur at lead levels exceeding 80 micrograms/100 grams. Inhibited hemoglobine synthesis is more common in chronic cases whereas shortened erythrocyte life span is more common in acute cases.

In lead-induced anemias, there is usually a reticulocytosis along with the presence of basophilic stippling, and ringed sideroblasts, although none of the above are pathognomonic for lead-induced anemia.

B. Neurological effects. Inorganic lead has been found to have toxic effects on both the central and peripheral nervous systems. The earliest stages of led-induced central nervous system effect first manifest themselves in the form of behavioral disturbances and central nervous system symptoms including irritability, restlessness, insomnia and other sleep disturbances, fatigue, vertigo, headache, poor memory, tremor, depression, and apathy. With more sever exposure, symptoms can progress to drowsiness, stupor, hallucinations, deuterium, convulsion and coma.

The most severe and acute form of lead poisoning which usually follows ingestion or inhalation of large amounts of lead is acute encephalopathy which may arise precipitously with the onset of intractable seizures, coma, cardiore-spiratory arrest, and death within 48 hrs.

While there is disagreement about what exposure levels are needed to produce the earliest symptoms, most experts agree that symptoms definitely can occur at blood lead levels of 60 microgreams/100 grams whole blood and therefore recommend at 40 micrograms/100 grams maximum. The central nervous system effects frequency are not reversible following discontinued exposure or chelation therapy and when improvement does occur, it is almost always only partial.

The peripheral neuropathy resulting from lead exposure characteristically involves only motor function with minimal sensory damage and ahs a marked predilection for the extensor muscles of the most active extremity. The peripheral neuropathy can occur with varying degree of severity. The earliest and mildest form which can be detected in workers with blood lead levels as low as 50 micrograms/100 is manifested by slowing of motor nerve conduction velocity often without clinical symptoms. With progression of the neuropathy there is development of painless extensor muscle weakness usually involving the extensor muscles of the fingers

and hand in the most active upper extremity, followed in severe cases by wrist drop or, much less commonly, foot drop.

In addition to slowing of nerve conduction, electromyographical studies in patients with blood lead levels greater than 50 microgrrams/100 grams have demonstrated a decrease in the number of acting motor unit potentials, an increase in the duration of motor unit potentials, and spontaneous pathological activity including fibrillations and fasciculations. Whether threes effects occur at levels of 40 micrograms/100 grams is undetermined.

While the peripheral neuropathies can occasionally be reversed with therapy, again such recovery is not assured particularly in the more severe neuropathies and often improvement is only partial. The lack of reversibility is felt to be due in part to segmental demyelination.

C. Gastrointestinal. Lead may also affect the gastrointestinal system producing abdominal colic or diffuse abdominal pain, constipation, obstipation, diarrhea, anorexia, nausea and vomiting. Lead colic rarely develops at blood lead levels below 80 micrograms/100 grams.

D. Renal. Renal toxicity represents one of the most serious health effects of lead poisoning. IN the early stages of disease nuclear inclusion bodies can frequently be identified in proximal renal tubular cells. Renal function remains normal and the changes in this stage are probably reversible. With more advanced disease there is progressive interstitial fibrosis and impaired renal function. Eventually extensive interstitial fibrosis ensures with sclerotic glomeruli and dilated and atrophied proximal tubules; all represent end stage kindly disease. Azotemia can be progressive, eventually resulting in frank uremia necessitating dialysis. There is occasionally associated hypertension and hyperuricemia with or without gout.

Early kindly disease is difficult to detect. The urinalysis is normal in early lead nephropathy and the blood urea nitrogen and serum creatinine increase only when two-thirds of kidney unction is lost. Measurement of creatinine clearance can often detect earlier disease as can other methods of measurement of glomerular filtration rate. An abnormal Ca-EDTA mobilization test has been used to differentiate between, lead-induced and other nephropathies, but this procedure is not widely accepted. A form of Fanconi syndrome with aminoaciduraia, glycosuria, and hyperphosphaturia indicating severe injury to the proximal renal tubules is occasionally seen in children.

E. Reproductive effects. Exposure to lead can have serious effects on reproductive function in both males and females. In male workers exposed to lead there can be a decrease in sexual drive, impotence, decreased ability to produce healthy sperm, and sterility. Malformed sperm (teratospermia), decreased number of sperm (hypospermia), and sperm with decreased motility (asthenopermia) can all occur. Teratospermia has been noted at mean blood lead levels of 53 micrograms/100 grams and hypospermia and asthenopermia at 41 micro-grams/100 grams. Furthermore, there appears to be a dose-response relation-ship for teratospermia in lead exposed workers.

Women exposed to lead may experience menstrual disturbances including dynmenorrhea, menorrhagia and amenorrhea. Following exposure to lead, women

have a higher frequency of sterility, premature births, spontaneous miscarriages, and stillbirths.

Germ cells can be affected by lead and cause genetic damage in the egg or sperm cells before conception and result in failure to implant, miscarriage, and stillbirths.

Infants of mothers with lead poisoning have a higher mortality during the first year and suffer from lowered birth weights, slower growth, and nervous system disorders.

Lead can pass through the placental barrier and lead levels in the mother's blood are comparable to concentrations of lead in the umbilical cord at birth. Transplacental passage becomes detectable at 12-14 weeks of gestation and increases until birth.

There is little direct data on damage to the fetus from exposure to lead but it is generally assumed that the fetus and newborn would be at least as susceptible to neurological damage as young children can cause significant neurobeha-vioral impairments and there is evidence of hyperactivity at blood levels as low as 25 microgreams/100 grams. Given the overall body of literature concerning the adverse health effects of lead in children. It is recommended that the blood lead level in children should be maintained below 30 micrograms/100 grams with a population mean of 15 microgram/100 grams. Blood lead levels in the fetus and newborn likewise should not exceed 30 micrograms/100 grams.

Because of lead's ability to pass through the pacental barrier and also because of the demonstrated adverse effects of lead on reproductive function in both the male and females as well as the risk of genetic damage of lead on both the ovum and sperm, it is recommended that 30 micrograms/100 grams maximum permissible blood lead level in both males and females who wish to bear children.

F Other Toxic Effects. Debate and research continue on the effects of lead on the human body. Hypertension has frequently been noted in occupationally exposed individuals although it is difficult to assess whether this is due to lead's adverse effects on the kidney or if some other mechanism is involved. Vascular and electrocardiographic changes have been detected but have not been will characterized. Lead is though to impair thyroid function and interfere with the pituitary-adrenal axis, but again these effects have not bee well defined.

3. Medical Evaluation

The most important principle in evaluation a worker for any occupational diseases including lead poisoning is a high index of suspicion on the part of the examining physician. As discussed in Section 2, lead can affect numerous organ systems and produce a wide array of signs and symptoms, most of which are non-specific and subtle in nature at least in the early stages of disease. Unless serious concern for lead toxicity is present, many of the early clues to diagnosis may earily be overlooked.

The crucial initial step in the medical evaluation is recognizing that a worker's employment can result in exposure to lead. The worker will frequency be able to define exposures to lead and lead containing materials but often will not volunteer this information unless specifically asked. In containing materials but often will not volunteer this information unless specifically asked. In other situations the worker may

not know of any exposures to lead but the suspicion might be raised on the part of the physician because of the industry or occupation of the worker. Potential occupational exposure to lead and its compounds occur in at least 120 occupation, including lead smelting, the manufacture of lead storage batteries, the manufacture of lead pigments and products containing pigments, solder manufacture, shipbuilding and ship repair, auto manufacturing, construction, and painting.

Once the possibility for lead exposure is raised, the focus can then be directed toward eliciting information from the medical history, physical exam, and finally from laboratory data to evaluate the worker for potential lead toxicity.

A complete and detailed work history is important in the initial evaluation. A listing of all previous employment with information on work process, exposure to fumes or dust, known exposure to lead or other toxic substances, respiratory protection used, and previous medical surveillance should all be included in the worker's record. Where exposure to lead is work areas, laundry procedures, and use of any protective clothing or respiratory protection equipment should be noted. A complete work history is essential in the medical evaluation of a worker with suspected lead toxicity, especially when long-term effects such as neurotoxicity and nephrotoxicity are considered.

The medical history is also of fundamental importance and should include a listing of al l past and current medical conditions, current medications including proprietary drug intake, previous surgeries and hospitalization, allergies, smoking history, alcohol consumption, and also non-occupational lead exposure such as hobbies (hunting, riflery). Also known childhood exposures should be elicited. Any previous history of hematological, neurological, gastrointestinal, renal, psychological, gynecological, genetic, or reproductive problems should be specifically noted.

A careful and complete review of systems must be performed to assess both recognized complaints and subtle or slowly acquired symptoms which the worker might not appreciate as being significant. The review of symptoms should include the following:

- General weight loss, fatigue, decreased appetite.
- Head, eyes, ears, nose, throat (HEENT), headaches, visual disturbances or decreased visual acuity, haring deficits or tinnitus, pigmentation of the oral mucosa, or metallic taste in mouth.
- Cardio-pulmonary – shortness of breath, cough, chest pains, palpitations or orthopnea.
- Gastrointestinal – nausea, vomiting, heartburn, abdominal pain, constipation or diarrhea.
- Neurologic – irritability, insomnia, weakness (fatigue), dizziness, loss of memory, confusion, hallucinations, in co-ordination, ataxia, decreased strength in hands or feet, disturbances in gait, difficulty in climbing stairs, or seizures.
- Hematologic – pallor, easy fatigability, abnormal blood loss, melena.
- Reporductive (male and female and spouse where relevant) history of infertility, impotence, loss of libido, abnormal menstrual periods, history of miscarriages, or children with birth defects.
- Musculo-skeletal-muscle and joint pains.

The physical examination should emphasize the neurological, gastrointestinal, and cardiovascular systems. The worker's weight and blood pressure should be record and the oral mucosa checked for pigmentation characteristic of a possible Burtonian or lad line on the gingival. It should be noted, however, that the lead line may not be present even in sever lead poisoning if good oral hygiene is practiced.

- The presence of pallor on skin examination may indicate an anemia, which if severe might also be associated with a tachycardia. If an anemia is suspected, an active search for blood loss should be undertaken including potential blood loss through the gastrointestinzl tract.
- A complete neurological examination should include an adequate mental status evaluation including a search for behavioral and psychological disturbances, memory testing, evaluation for irritability, insomnia, hallucinations, and mental clouding. Gait and coordination should be examined along with close observation for tremor. A detailed evaluation of peripheral nerve function including careful sensory and motor function testing is warranted. Strength testing particularly of extensor muscle groups of all extremities is of fundamental importance.
- Cranial nerve evaluation should also be included in the routine examination.

  The abdominal examination should include ausculation for bowel sounds and abdominal bruits and palpation for organomegaly, masses, and diffuse abdominal tenderness.
- Cardiovascular examination should evaluate possible early sings of congestive heart failure. Pulmonary status should be addressed particularly if respirator protection is contemplated.
- As part of the medical evaluation, the lead standard requires the following laboratory studies:

1. Blood lead level
2. Hemoglobin and hematocrit determinations, red cell indices, and examination of the peripheral blood smear to evaluate red blood cell morphology.
3. Blood urea nitrogen
4. Serum creatinine
5. Routine urinalysis with microscopic examination
6. A zinc protoporphyrin level (recommended)

In addition to the above, the physician is authorized to order any further laboratory or other tests which he or she deems necessary in accordance with sound medical practice. The evaluation must also include pregnancy testing or laboratory evaluation of male fertility if requested by the employee.

Additional tests which are probably not warranted on a routine basis but may appropriate when blood lead and ZPP levels are equivocal include delta aminolevulinic acid and coproporphyrin concentrations in the urine, and dark-field illumination for detection of basophilic stippling in red blood cells.

If an anemia is detected further studies including a careful examination of the peripheral smear, reticulocyte count, stool for occult blood, serum iron, total iron binding capacity, bilirubin, and, if appropriate, vitamin B12 and floate may be of value in attempting to identify the cause of the anemia.

If a peripheral neuropathy is suspected, nerve conduction studies are warranted both for diagnosis and as a basis to monitor any therapy.

If renal disease is questioned, a 24 hr urine collection for creatinine clearane, protein, and electrolytes may be indicated. Elevated uric acid levels may result from lead-induced renal disease and a serum uric acid level might be performed.

An electrocardiogram and chest x-ray may be obtained as deemed appropriate.

Sophisticated and highly specialized testing should not be done routinely and where indicated should be under the direction of a specialist.

4. Laboratory Evaluation

The blood lead level at present remains the single most important test to monitor lead exposure and is the test used in the medical surveillance program under the lead standard to guide employee medical removal. The ZPP which has several advantages over the blood lead level is not required under the standard. Because of its relatively recent development and the lack of extensive data concerning its interpretation, the ZPP currently remains an ancillary test.

This section will discuss the blood lead level and ZPP in detail and will outline their relative advantages and disadvantages. Other blood tests currently available to evaluate lead exposure will also be reviewed.

The blood lead level is a good index of current or recent lead absorption when there is no anemia present and when the worker has not taken any chelating agents. However, blood lead levels along with urinary lead levels do not necessarily indicate the total body burden of lead and are not adequate measures of past exposure. One reason of this is that lead has a high affinity for bone and up to 90 percent of the body's total lead is deposited there. A very important component of the total lead body burden is lead in soft tissue (liver, kidney, and brain). This fraction of the lead body burden, the biologically active lead, is not entirely reflected by blood lead levels since it is a function of the dynamics of lead absorption, distribution, deposition in bone and excretion. Following discontinuation of exposure to lead, the excess body burden is only slowly mobilized from bone and other relatively stable body stores and excreted. Consequently , a high blood lead level may only represent recent heavy exposure to lead without a significant total body excess and likewise a low blood lead level does not exclude an elevated total body burden of lead.

Also due to its correlation with recent exposures, the blood lead level may vary considerably over short time intervals.

To minimize laboratory error and erroneous results due to contamination, blood specimens must be carefully collected after thorough cleaning of the skin with appropriate methods using lead-free blood containers and analyzed by a reliable laboratory. Under the standard, samples must be analyzed in laboratories which are approved. Under standards, 75 percent of blood lead determinations are not to vary from

reference values by more than 15 percent of 6 micrograms/100 ml, whichever is greater. Analysis is to be made using atomic absorption spectrophotometry.

The determination of lead in urine is generally considered a less reliable monitoring technique than analysis of whole blood primarily due to individual variability in urinary excretion capacity as well as the technical difficulty of obtaining accurate 24 hr urine collections. In addition, workers with renal insufficiency, whether due to lead or some other cause, a may have decreased led clearance and consequently urine lead levels may underestimate the true lead burden. Therefore, urine lead levels should not be sued as a routine test.

The zinc protoporphyrin test, unlike the blood lead determination, measures and adverse metabolic effect of lead and as such is a better indicator of lead toxicity than the level of blood lead itself. The level of ZPP reflects lead absorption over the preceding 3 to 4 months, and therefore, is a better indicator of lead body burden. The ZPP requires more time than the blood lead to read significantly elevated levels; the return to normal after discontinuing lead exposure is also slower. Furthermore, the ZPP test is simpler, faster, and less expensive to perform and no contamination is possible. Many investigators believe tit is the most reliable means of monitoring chronic lead absorption.

Zinc protoporphyrin results from the inhibition of the enzyme ferrochelatase which catalyzes the insertion of an iron molecule into the protoporphyrin molecule, which then becomes heme. If iron is not inserted into the molecule then zinc, having a greater affinity for protoporphyrin, takes the place of the iron, forming ZPP.

An elevation in the level of circulating ZPP may occur at blood lead levels as low as 20-30 micrograms/100 grams is some workers. Once the blood lead level has reached 40 micrograms/100 grams there is more marked rise in the ZPP value from its normal rage of less than 100 microgram/100 ml. Increases in blood lead levels beyond 40 microgram/100 are associated with exponential increases in ZPP.

Whereas blood lead levels fluctuate over short time spans. ZPP levels remain relatively stable. ZPP is measured directly in red blood cells and is present for the cell's entire 120 day life-span. Therefore, the ZPP level in blood reflects the average ZPP production over the previous 3-4 months and consequently the average lead exposure during that time interval.

It is recommended that a hematocrit be determined whenever a confirmed ZPP of 50 micrograms/100 ml whole blood is obtained to rule out a significant underlying anemia. If the ZPP is in excess of 100 micrograms/100 ml and not associated with abnormal evaluations in blood lead levels, the laboratory should be checked to be sure that blood leads were determined using atomic absorption spectorphotometery anodic stripping voltammetry, or any method which meets the accuracy requirements set forth by the standard by an apporo9ved laboratory which is experienced in lead level determinations. Repeat periodic blood lead studies should be obtained in all individuals which elevated ZPP levels to be certain that an associated elevated blood lead levels has not been missed due to transient fluctuations in blood leads.

ZZP has a characteristic fluorescene spectrum with a peak at 594 nanometer which is detectable with a hematofluorimeter. The hematofluorimeter is accurate and portable and can provide on site, instantaneous results for workers who can be frequently tested via a finger prick.

However, careful attention must be given to calibration and quality control procedures. Limited data on blood lead – ZPP correlations and the ZZP levels which are associated with the adverse health effects discussed in Section 2 are the major limitations of the test. Also it is difficult to correlate ZPP levels with environmental exposure and there is some variation of response with age and sex. Nevertheless, the ZPP promises to be an important diagnostic test for the early detection of lead toxicity and its value will increase as more date is collected regarding its relationship to other manifestations of lead poisoning.

Levels of delta-aminoleveulinic acid (ALA) in the urine are also used as a measure of lead exposure. Increasing concentrations of ALA are believed to result form the inhibition of the enzyme delta-aminolevulinic acid dehydrase (ALA-D). although the test is relatively easy to perform, inexpensive, and rapid, the disadvantages include variability in results, the necessity to collect a complete 24 hr urine sample which has a specific gravity greater than 1.010, and also the fact that ALA decomposes in the presence of light.

The pattern of porphyrin excretion in the urine can also be helpful in identifying lead intoxication. With lead poisoning, the urine concentrations of coproporphyrins 1 and 2, prophobilinogen and uroporphyrin 1 rise. The most important increase, however, is that of coproporphyrin 3; levels may exceed 5000 micrograms/1 in the urine in lead poisoned individuals, but its correlation with blood lead levels and PP are note as good as those of ALA. Increases in urinary porphyrins are not diagnostic of lead toxicity and may be seen in prophyria, some liver diseases, and in patients with high reticulocyte counts.

Summary. With adequate worker education on the adverse health effects of lead and appropriate training in work practices, personal hygiene and other control measures, the physician has a primary responsibility for evaluating potential lead toxicity in the worker. It is only through a careful and detained medical and work history, a complete physical examination and appropriate careful and detailed medical and work history , a complete physical examination and appropriate laboratory testing that an accurate assessment can be made. Many of the adverse health effects of lead toxicity are either irreversible or only partially reversible and therefore early detection of disease is very important.

This document outlines the medical monitoring program as defined by the occupational safety and health standard for inorganic lead. It reviews the adverse health effects of lead poisoning and describes the important elements of the history and physical examinations as they relate to these adverse effects.

Finally, the appropriate laboratory testing for evaluating lead exposure and toxicity is presented.

It is hoped that this review and discussion will give the physician a better understanding of the concerned authorities standard with the ultimate goal of protecting the health and well-being of the worker exposed to lead under his or her care.

6 Acrylonitrile

4.5.6.1 Definitions

— Acrylonitrile or AN. Acrylonitrile monomer chemical formula CH_2 = CHCN.

— Action level. A concentration of AN of 1 ppm averaged over any 8 hour period.

— Authorized Person. Any person specifically authorized by the employer and whose duties require the person to enter a regulated area, or any person entering such an area as a designated representative of employees exercising an opportunity to observer employee exposure monitoring under subparagraph 6.16.

— Decontamination. Treatment of materials and surfaces by water wash down ventilation, or other means, to assure that the materials will not expose employees to airborne concentrations of AN above 1 ppm as an 8 hour time-weighed average.

— Emergency. Any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment, which results in an unexpected massive release of AN.

— Liquid AN. An monomer in liquid form, and liquid or semiliquid polymer intermediates, including slurries, suspensions, emulsions, and solutions produced during the polymerizaation of AN.

6.2 Scope

6.2.1 This paragraph applies to all occupational exposures to acrylonitrile (AN), except as provided in subparagraph 6.2.2.

6.6.2 This paragraph does not apply to the processing, use, and handling of the following materials:

6.2.2.1 Acrylonitile-Butadiene-Styrene (ABS) resins, Styrene-Acrylonitrile (SAN) resins, nitrile barrier resins, solid nitrile elastomers, and acrylic and modacrylic fibers, when these listed materials are in the form of finished polymers, and products fabricated from such finished polymers.

6.2.2.2 Materials made from and/or containing AN for which objective data is reasonably relied upon to demonstrate that the material is not capable of releasing AN in airborne concentrations in excess of 1 ppm as an 8 hrs time-weighted average,

6.2.2.3 Solid materials made from and/or containing AN which will not be heated above 77^oC during handling, use, or processing.

6.2.3 An employer relying upon exemption under subparagraph 6.2.2.2 shall maintain records of the objective data supporting that exemption, and of the basis of the employers; reliance on the data, as provided in subparagraph 6.15.

6.3 Permissible Exposure limit

6.3.1 Inhalation

6.3.1.1 The employer shall assure that no employee is exposed to an airborne concentration in excess of 2 parts AN per million parts, as an 8-hours time-weighted average.

6.3.1.2 The employer shall assure that no employee is exposed to an airborne concentration in excess of 10 parts AN per million parts of air as averaged over any 15 minutes during the working day.

6.3.2 The employer shall assure that o employee is exposed to skin contact or eye contact with liquid AN.

6.4 Regulated Areas

6.4.1 Within 30 days following the establishment of a regulated area, the employer who has a workplace water AN is present shall report the following information to the nearest concerned authorities for each such workplace.

6.4.1.1 The address and location of each establishment which has one or more regulated area;

6.4.1.2 A brief description of each process of operation which results in employee exposure to AN in regulated areas; and

6.4.1.3 The number of employee engaged in each process or operation within each regulated area which results in exposure to AN and an estimate of the frequency and degree of exposure that occurs; and

6.4.1.4 A brief description of the employee's safety and health program as it relates to limitation of employee exposure to AN.

6.5 Exposure Monitoring

6.5.1 Determinations of airborne exposure levels shall be made from air samples that are representative of each employee's exposure to AN over an 8-hour period. (For the purposes of this paragraph, employee exposure is that which would occur if the employee where not using a respirator).

4.5.6.5.2 Each employer who has a place of employment in which AN is present shall monitor each such workplace and work operation to accurately determine the airborne concentrations of AN to which employees may be exposed. Such monitoring may be done on a representative basis, provided that the employer can demonstrate that these determinations are representative of employee exposures.

6.5.3 If the monitoring required by this paragraph reveals employee exposure to be below the action levels, the employer may discontinue monitoring for that employee.

6.5.4 If the monitoring reveals employee exposure to be at or above the action level but below the permissible exposure limits, the employer shall repeat the monitoring at least quarterly. The employer shall continue these quarterly measurements a unit at least two consecutive measurements, taken at least 7 days apart, are below the action level, and thereafter the employer may discontinue monitoring except as provided in subparagraph 6.5.4.

6.5.5 If the monitoring reveals employee exposure to be in excess of the permissible exposure limits the employer shall repeat these determinations for each such employee at least monthly. The employer shall continue these monthly measurements until at least two consecutive measurements, taken at least 7 days apart, are below the permissible exposure limits, and thereafter the employer shall monitor at least quarterly.

6.5.6 Whenever there has been a production, process, control, or personnel change which may result in new or additional exposures to AN, or whenever the employer has any other reason to suspect a change which may result in new or additional exposures to AN, additional monitoring which complies with this subparagraph shall be conducted.

6.5.7 Within 5 working days after the receipt of monitoring results, the employer shall notify each employee in writing of the results which represent that by employee's exposure.

6.5.8 Whenever the results indicate that the representative employee's exposure exceeded the permissible exposure limits, the employer shall include in the written notice a statement that the permissible exposure limits are exceed and a description of the corrective action being taken to reduce exposure to or below the permissible exposure limits.

6.5.9 The method of measurement shall be accurate, to a confidence level of 95 percent, to within ± 35 percent for concentrations of AN at or above the permissible exposure limits, and to within ± 50 percent for concentrations below the permissible exposure limits.

6.6 Related Areas

6.6.1 The employer shall establish regulated areas where AN concentrations are in excess of the permissible exposure limits.

6.6.2 Regulated areas shall be demarcated and segregated from the rest of the workplace, in any manner that minimizes the number of persons will be exposed to AN.

6.6.3 Access to regulated areas shall be limited to authorized persons or to persons otherwise authorized by the act or regulations issued pursuant thereto.

6.6.4 The employer shall assure that food or beverages are not present or consumed, tobacco products are not present or used, and cosmetics are not applied in the regulated area.

6.7 Methods of Compliance

6.7.1 The employer shall institute engineering and work practice controls to reduce and maintain employee exposure to AN, to or below the permissible exposure limits, except to the extent that the employer establishes that such controls are not feasible.

6.7.2 Whenever the engineering and work practice controls which can be instituted are not sufficient to reduce employee exposure to or below the permissible exposure limits, the employee shall nonetheless use them to reduce exposure s to the lowest

levels achievable by these controls, and shall supplement them by the use of respiratory protection.

6.7.3 The employer shall establish and implement a written program to reduce employee exposures to or below the permissible exposure limits solely by means of engineering and work practice controls, as required by subparagraph 6.7.1

6.7.4 Written plans for these compliance programs shall include at least the following:

6.7.4.1 A description of each operation or process resulting in employee exposure to AN above the permissible exposure limits;

6.7.4.2 An outline of the nature of the engineering controls and work practices to be applied to the operation or process in question;

6.7.4.3 A report of the technology considered in meeting the permissible exposure limits.

6.7.4.4 A schedule for implementation of engineering and work practice controls for the operation or process, which shall project completion; and

6.7.4.5 Other relevant information

6.7.5 The employer shall complete the steps set forth in the compliance program by the dates in the schedule.

6.7.6 Written plans shall be submitted upon request to concerned authority, and shall be available at the worksite for examination and copying by concerned authority, or any affected employee or representative.

6.7.7 The plans required by this paragraph shall be revised and updated at least every 6 months to reflect the current status of the program.

6.8 Respiratory protection

6.8.1 The employer shall assure that respirators are used where required by this paragraph to reduce employee exposure to within the permissible exposure limits. Respirators shall be used in the following circumstances:

6.8.1.1 During the time period necessary to install or implement feasible engineering and work practice controls;

6.8.1.2 In work operations, such as maintenance and repair activities or reactor cleaning, in which the employer establishes that engineering and work practice controls are not feasible;

6.8.1.3 In work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the permissible exposure limits: and

6.8.1.4 In emergencies.

6.8.2 Where respiratory protection is required under this paragraph, the employer shall select and provide, at not cost to the employee, the appropriate type of respirator from Table 5, and shall assure that the employee wear the respirator provided.

Table 4.5-5
Respiratory Protection for Acrylonitrile (AN)

Concentration of AN or condition of use	Respirator type
(1) Less than or equal to 20 ppm	(1) Chemical cartridge respirator with organic vapor cartridge(s) and half-mask face-piece; or (2) Supplied air respirator with half-mask face-piece.
(b) Less than or equal to 100 ppm or maximum use concentration (MUC) of cartridges or canisters, whichever is lower.	(1) Full facepiece respirator with (A) organic vapor cartridges, (B) organic vapor gas mask chin-style, or (C) organic vapor gas mask canister, front or back mounted; (2) Supplied air respirator with full facepiece; or (3) Self-contained breathing apparatus with full facepiece.
(c) Less than or equal to 4,000 ppm	(1) Supplied air respirator operated in the positive pressure mode with full facepiece helmet, suit, or hood
(d) Greater than 4,000 ppm or unknown concentration.	(1) Supplied air and auxiliary self-contained breathing apparatus with full facepiece in positive pressure mode; or (2) Self-contained breathing apparatus with full facepiece in positive pressure mode.
(e) Firefighting	Self-contained breathing apparatus with full facepiece in positive pressure mode.
(f) Escape	(1) Any organic vapor respirator, or (2) Any self-contained breathing apparatus

6.8.3 Respirator program

6.8.3.1 The employer shall institute a respiratory protection program in accordance with Section 5.3.

6.8.3.2 Where air-purifying respirators (chemical) cartridges or canister-type gas mask) are used, the air-purifying canister, or cartridge(s) shall be replaced prior to the expiration of their service life or at the beginning of each shift, whichever occurs first. A label shall be attached to the cartridge or canister to indicate the date and time at which it is first installed on the respirator.

6.8.3.3 The employer shall allow each employee who uses a filter respirator (cartridge or canister) to change the filter elements whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

6.8.3.4 Employees who wear respirators shall be allowed to wash their faces and respirator face pieces to minize potential skin irritation associated with respirator use.

6.8.3.5 Fit testing of respirators shall be performed to assure that the respirator selected provides the protection required by Table 5.

6.8.3.6 The employer shall perform qualitative fit test at the time of initial fitting and at least semiannually thereafter for each employee wearing respirators.

6.8.3.7 Each employer with more than 10 employees wearing negative pressure respirators shall perform quantitative fit testing at the time of initial fitting and at least semiannually thereafter for each such employee.

6.9 Protective clothing and equipment

6.9.1 Where eye or skin contact with liquid AN may occur, the employer shall provide at no cost to the employee, and assure that employees wear, appropriate impermeable protective clothing or other equipment in accordance with Section 5.3 and 5.6 to protect any area of the body which may come in contact with liquid AN.

6.9.2 Cleaning and replacement

6.9.2.1 The employer shall clean, launder, maintain, or replace protective clothing and equipment by this subparagraph as needed to maintain their effectiveness.

6.9.2.2 The employer shall assure that impermeable protective clothing which contacts or is likely to have contacted liquid AN shall be decontaminated before being removed by the employee.

6.9.2.3 The employer shall assure that an employee whose no impermeable clothing becomes wetted with liquid AN shall immediately remove that clothing and proceed to shower. The clothing shall be decontaminated before it is removed from the regulated area.

6.9.2.4 The employer shall assure that no employee removes protective clothing or equipment from the change room, except for those employees authorized to do so for the purpose of laundering, maintenance, or disposal.

6.9.2.5 The employer shall inform any person who launders or cleans protective clothing or equipment of the potentially harmful effects of exposure to AN.

6.10 Housekeeping

6.10.1 All surfaces shall be maintained free of accumulations of liquid of AN.

6.10.2 For operations involving liquid AN, the employer shall institute a program for detecting leaks and spills of liquid AN, including regular visual inspections.

6.10.3 Where spills of liquid AN are detected, the employer shall assure that surfaces contacted by the liquid AN engaged are decontaminated. Employees not engaged in decontamination activities shall leave the area of the spill, and shall not be permitted in the area until decontamination is completed.

6.10.4 Where employees are exposed to airborne concentrations of AN above the permissible exposure limits, or where employees are required to wear

protective clothing or equipment, facilities including clean change rooms and shower facilities, shall be provided by the employer for the use of those employees, and the employer shall assure that the employees use the facilities provided.

6.10.5 The employer shall assure that employees wearing protective clothing or equipment for protection from skin contact with liquid AN shall shower at the end of the work shift.

6.10.6 The employer shall assure that, in the event of skin or eye exposure to liquid AN, the affected employee shall shower immediately to minimize the danger of skin absorption.

6.10.7 The employer shall assure that employees working in the regulated area wash their hands and faces prior to eating.

6.11 Medical surveillance

6.11.1 General

6.11.1.1 The employer shall institute a program of medical surveillance for each employee who is or will be exposed to AN at or above the action level, without regard to the use of respirators. The employer shall provide each such employee with an opportunity for medical examinations and tests in accordance with this subparagraph.

6.11.1.2 The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and shall be provided without cost to the employee.

6.11.2 Initial examination. At the time of initial assignment, the employer shall provide each affected employee an opportunity for a medical examination, including at least the following elements:

6.11.2.1 A work history and medical history with special attention t skin, respiratory , and gastrointestinal systems, and those non-specific symptoms, such as headache, nausea, vomiting, dizziness, weakness or other central nervous system dysfunctions that may be associated with acute or with chromic exposure to AN.

6.11.2.2 A physical examination giving particular attention to the peripheral and central nervous system, gastrointestinal system, respiratory system, skin, and thyroid.

6.11.2.3 A 35 x 43 cm posteroanterior chest X-ray.

6.11.2.4 Further tests of the intenstinal tract, including fecal occult blood screening, on all workers 40 years of age or older and to any other affected employees for whom, in the opinion of the physician, such testing would be appropriate.

6.11.3 Periodic examinations

6.11.3.1 The employer shall provide the examinations specific at least annually for all employees specified in subparagraph 6.11.1.1.

6.11.3.2 If an employee has not had the examination specified in subparagraph 6.11.2 within 6 months preceding termination of employment, the employer shall make such examination available to the employee prior to such termination.

6.11.4 Interim examinations. If the employee for any reason develops signs or symptoms commonly associated with exposure to AN, the employer shall provide appropriate examination and emergency medical treatment.

6.11.5 Information provided to the physician. The employer shall provide the following information to the examining physician:

— A copy of this standard and its appendices;

— A description of the affected employee's duties as they relate to the employee's exposure;

— A description of any personal protective equipment used or to be used.

— The employee's anticipated or estimated exposure level (for replacement examinations or in cases of exposure due to an emergency);

— Information from previous medical examinations of the affected employee, which is not otherwise available to the examining physician.

6.11.6 Physician's written opinion

6.11.6.1 The employer shall obtain a written opinion from the examining physician which shall include:

— The results of he medical test performed;

— The physician's opinion as to whether the employee has any detected medical condition which would place the employee at an increased risk of material impairment of the employee's health from exposure to AN;

— Any recommended limitations upon the employee's exposure to AN or upon the use of protective clothing and equipment such as respirators; and

— A statement the employee has been informed by the physician of the results of the medical examination and an medical conditions which require further examination or treatment.

6.11.6.2 The employer shall instruct the physician not to reveal in the written opinion specific findings or diagnoses unrelated to occupational exposure to AN.

6.11.6.3 The employer shall provide a copy of the written opinion to the affected employer.

6.12 Employee information and training

6.12.1 The employer shall institute a training program for and assure the participation of all employees exposed to AN above the action level, all employees whose exposures are maintained below the action level by engineering and work practice controls, and all employees subject to potential skin or eye contact with liquid AN.

6.12.2 Training shall be provided at the time of initial assignment, or upon institution of the training program, and at least annually thereafter, and the employer shall assure that each employee is informed of the following:

— The information contained in appendices A and B.

— The quantity, location, manner of use, release, or storage of AN, and the specific nature of operations which could result in exposure to AN, as well as any necessary protective steps;

— The purpose, proper use, and limitations of respirators and protective clothing;

— The purpose and a description of the medical surveillance program required by subparagraph 6.11;

— The emergency procedures developed, as required by subparagraph 6.16;

— Engineering and work practice controls, their function, and the employee's relationship to these controls; and

— A review of this standard.

6.12.3 The employer shall make a copy of this standard and its appendices readily available to all affected employees.

6.12.4 The employer shall provide, upon request, all materials relating to the employee information and training program to the concerned authority.

6.13 Signs and labels

6.13.1 The employer may use labels or signs required by other statues, regulations or ordinances in addition to, or in combination with, signs sand lables required by this subparagraph.

6.13.2 The employer shall assure that no statement appears on or near any sign or label, required by this subparagraph, which contradicts or detracts from such effects of the required sign or label.

6.13.3 The employer shall post signs to clearly indicate all workplaces where AN concentrations exceed the permissible exposure limits. The signs shall bear the following legend;

DANGER

ACRYLONITRILE (AN)

CANCER HAZARD

AUTHORIZED PERSONS ONLY

RESPIRATIORS MAY BE REQUIRED

6.13.4 The employer shall assure that signs required by this subparagraph are illuminated and cleaned as necessary so that the legend is readily visible.

6.13.5 The employer shall assure that precautionary labels are affixed to all containers of liquid AN and AN-based materials not expected under subparagraph 6.2.2. The employer shall assure that the labels remain affixed when the materials are sold, distributed, or otherwise level the employer's workplace.

6.13.6 The employer shall assure that the precautionary labels required by this subparagraph are readily visible and legible. The labels shall bear the following legend;

DANGER

CONTAINS ACRYLONITRILE (AN)

CANCER HAZARD

6.14 Record keeping

6.14.1 Where the processing, use, and handling of materials made from or containing AN are exempted pursuant to subparagraph 6.2.2, the employer shall establish and maintain an accurate record of objective data reasonably relied upon in support of the exemption.

6.14.2 This record shall include the following information:

— The relevant condition in subparagraph 6.2.2 upon which exemption is based:

— The source of the objective data;

— The results of testing and analysis of the material being processed;

— A description f the operation exempted; and

— Other data relevant to the operation, materials, and processing covered by the exemption.

6.14.3 The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

6.14.4 The employer shall establish and maintain an accurate record of all monitoring required by subparagraph 6.5.

6.14.5 This record shall include;

— The dates, number, duration and results or each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure;

— A description of the sampling and analytical methods used and the data relied upon to establish that the methods used to meet the accuracy and precision requirements;

— Type of respiratory protective devices worn, if any; and

— Name, and job classification of the employee monitored and of all other employees whose exposure the measurement is intended to represent.

6.14.6 The employer shall maintain this record for at least 40 years or for the duration of employments plus 20 years whichever is longer.

6.14.7 The employer shall establish and maintain an accurate record for each employee subject to medical surveillance as required by subparagraph 6.12.

6.14.8 This record shall include:

— A copy of the physicians; written opinions;

— Any employee medical complaints related to exposure to AN

— A copy of the information provided to the physician; and

— A copy of the employee's work history.

6.14.9 The employer shall assure that this record required be made available upon request to the concerned authorities for examination and copying.

6.14.10 The employer shall assure that all record be maintained for at least 40 years or the duration of employment plus 20 years whichever is longer.

6.14.11 The employer shall assure that employee exposure measurement records be made available, upon request, for examination and copying to the affected employee, former employee, or designated representative.

6.14.12 The employer shall assure that employee medical records be made available, upon request, for examination and copying to the affected employee or former employee, or to a physician designated by the affected employee, former employee, or designated representative.

6.15 Observation of monitoring

6.15.1 The employer shall provide affected employees, or their designated representatives, an opportunity to observe any monitoring of employee exposure to AN conducted pursuant to subparagraph 6.5.

6.15.2 Whenever observation of the monitoring of the employee exposure to AN requires entry into an area where the use of protective clothing or equipment is required, the employer shall provided the observer with personal protective clothing or equipment required to be worn by employees working in the area, assure the use of such clothing and equipment, and require the observer to comply with all other applicable safety and health procedures.

6.15.3 Without interfering with the monitoring, observers shall be entitled:

– To receive an explanation of the measurement procedures;

– To observe all steps related to the measurement of airborne concentration of AN performed at the place of exposure, and

– To record the results obtained.

6.16 Emergencies

6.16.1 A written plan for emergency situations shall be developed for each workplace where liquid AN is present. Appropriate portions of the plan shall be implemented in the event of an emergency.

6.16.2 The plan shall specifically provide that employees engaged in correcting emergency conditions shall be equipped until the emergency is abated.

6.16.3 Employees not engaged in correcting the emergency shall be evacuated form the area and shall not be permitted to return until the emergency is abated.

6.16.4 Where there is the possibility of employee exposure to AN in excess of the ceiling limit, a general alarm shall be installed and used to promptly alert employers of such occurrences.

6.16.5 Emergencies, and the facts obtainable at that time, shall be reported within 72 hours of the initial occurrence to the concerned authorities. Upon request of concerned authorities the employer shall submit additional information in writing relevant to the nature and extent of employee exposure and measures taken to prevent future emergencies of a similar nature.

6.17 The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligations.

Appendix A

Substance Safety Data Sheet for Acrylonitrile

1. Substance Identification

A. Substance: Acrylonitrile (CH2 – CHCN).

B. synonyms: Propenenirile; vinyl cyanide; cyanoethylene; AN; VCN; acrylon; carbacryl; fumigrain, ventox.

C. Acrylonitirle can be found as a liquid or vapor, and can also be found in polymer resins, pastics, polyols, and other polymers having acrylonitrile as a raw or intermediate material.

D. AN is used in the manufacture of acrylic and modacrylic fibers, acrylic plastics and resins, specialty polymers, nitrile rubbers, and other organic chemicals, If has also been used a fumigant.

E. Appearance and odor: Colorless to pale yellow liquid with a pungent odor which can only be detected at concentrations above the permissible exposure level, in a range of 13-19 parts AN per million parts of air.

1. 2 parts AN per million parts of air averaged over the eight-hour workday; or

2. 10 parts AN per million parts of air averaged over any 15 minute period in the workday.

3. In addition, skin and eye contact with liquid AN is prohibited.

2. Health Hazard Data

A. Acrylonitrile can affect your body if you inhale the vapor (breathing) if it comes in contact with your eyes or skin, or if you swallow it. It may enter your body through your skin.

B. Effects of overexposure

1. Short-term exposure: Acrylonitrile causes eye irritation, nausea, vomiting, headache, sneezing, weakness, and light-headedness. At high concentrations, the effects of exposure may go on to loss of consciousness and death. When acrylonitrile is held in contact with the skin after being absorbed into shoe leather or clothing, it may produce blisters following several hours of no apparent effect. Unless the shoes or clothing are removed immediately and the area washed, blistering will occur. Usually there is no pain or inflammation associated with blister formation.

2. Long-term exposure: Acrylonitrile has been shown to cause cancer in laboratory animals and has been associated with higher incidences of cancer in humans. Repeated or prolonged exposure of the skin to acrylonitrile may produce irritation and dermatitis.

3. Reporting sings and symptoms: You should inform your employer if you develop any signs or symptoms which may be caused by exposure to acrylonitrile.

3. Emergency First Aid Procedures

A. Eye exposure. If acrylonitrile gets into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

B. Skin exposure: If acrylonitrile gets on your skin, immediately was the contaminated skin with water. If acrylonitrile soaks through your clothing, especially our shoes, remove the clothing immediately and wash the skin with water. If symptoms occur after washing, get medical attention immediately. Thoroughly wash the clothing before re-using. Contaminated leather shoes or other leather articles should be discarded.

C. Inhalation: If you or any other person breathes in large amounts of acrylonitriel, move the exposed person to fresh air, at one. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

D. Swallowing: When acrylonitrile has been swallowed, give the person large quantities of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.

E. Rescue; Move the affected person from the hazardous exposure . If the exposed person has been overcome, notify someone else and put into effect the established emergency procedures. Do not become a casualty yourself. Understand your emergency rescue procedures and know the locations of the emergency equipment before the need arises.

F. Special first aid procedures: First aid kits containing an adequate supply (at least two dozen) of amyl nitrite pearls, each containing 0.3 ml, should be maintained at each site where acrylonitrile is used. When a person is suspected of receiving an overexposure to acrylonitritle immediately remove that person from the contaminated are using established rescue procedures. Contaminated clothing must be removed and the acrylonitrile washed form the skin immediately. Artificial respiration should be started at once breathing has stopped. If the person is unconscious, amyl nitrite may be used as an antidote by a properly trained individual in accordance with established emergency procedures. Medical aid should be obtained immediately.

4. Respirators and protective clothing

A. Respirators: You may be required to wear a respirator for non-routine activities, in emergencies, and while your employer is in the process of reducing acrylonitrile exposure thorough engineering controls. If respirators, are worn, they must have an approved label. For effective protection, respirators must fit your face and head snugly. Respirators should not be loosened or removed in work situations where their use is required.

Acrylonitrile does not have a detectable odor except at levels above the permissible exposure limit. Do not depend on odor to warn you when a respirator cartridge or canister is exhausted.

Cartridges or canisters must be changed daily. Reuse of these may allow acrylonitrile to gradually filter through the cartridge and case exposure which you cannot detect by odor. If you can smell acrylonitrile while wearing a respirator, the respirator is not working correctly. Go immediately to fresh air. If you experience difficulty breathing while wearing a respirator tell your employer.

B. Supplied Air Suits: In some work situations, the wearing of supplied-air suits may be necessary. Your employer should instruct you in their proper use and operation.

C. Protective Clothing: You must wear impervious clothing, gloves, face shield, or other appropriate protective clothing to prevent skin contact with liquid acrylonitrile. Replace or repair impervious clothing that has developed leaks. Where protective clothing is required, your employer is required to provide clean garments to you as necessary.

Acrylonitrile should never be allowed to remain on the skin. Clothing and shoes should not be allowed to become contaminated with acrylonitrile, and if they do, the clothing should be promptly removed and laundered or discarded, and the shoes should be discarded. Once acrylonitrile penetrates shoe leather, or other leather articles, the article should not be worn again.

D. Eye Protection: You must wear splash-proof safety goggles in areas where liquid acrylonitrile may contact your eyes. In addition, contact lenses should not be worn in areas where eye contact with acrylonitrile can occur.

5. Precautions for Safe Use, Handling, and Storage

A. Acrylonitrile is a flammable liquid and its vapors can easily form explosive mixtures in air.

B. Acrylonitrile must be stored in tightly-closed containers in a cool, well-ventilated area, away from heat, sparks, flames, strong oxidizers (especially bromine), strong bases, copper, copper alloys, ammonia, and amines.

C. Sources of ignition such as smoking and open flames are prohibited wherever acrylonitrile is handled, used, or stored in a manner that could create a potential fire or explosion hazard.

D. You should use non-sparking tolls when opening or closing metal containers of acrylonitrile, and containers must be bonded and grounded when pouring or transferring liquid acrylonitrile.

E. You must immediately remove any non-impervious clothing that becomes contaminated with acrylonitrile, and this clothing must not be reworn until the acrylonitriele is removed from the clothing.

F. Clothing wet with liquid acrylonitrile can be easily ignited. You must wash down with water and remove this clothing, and its must not be reworn until the acrylonitrile is removed form the clothing.

G. If your skin becomes wet with liquid acrylinitrile, you must promptly and thoroughly was or shower with soap or mild detergent to remove any acrylonitrile from your skin.

H. You must not keep food, beverages, or smoking materials in areas where acrylonitrile is handled, processed, or stored, not are you permitted to each or smoke in these areas.

I. If you contact liquid acrylonitrile, you must wash you hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.

J. Fire extinguishers and quick drenching facilities must be readily available, and you should know where they are and how to operate them.

K. Ask you supervisor where acrylonitrile is used in your work area and for any additional plant safety and health rules.

6. Access of information

A. Each year, your employer is required to inform you of the information contained in this substance Safety Data Sheet for acrylonitrile, In addition, your employer must instruct you in this proper work-practices for using acrylonitrile, emergency procedures, and the correct use of protective equipment.

B. You employer is required to determine whether you are being exposed to acrylonitrile. You or your representative has the right to observe employee exposure measurements and to record the results obtained. Your employer is required to inform you of your exposure. If your employer determines that you are being overexposed, he or she is required to inform you of the actions which are being taken to reduce your exposure to within permissible exposure limits.

C. Your employer is required to keep records of your exposures and medical examinations. These record must be kept by the employer for at least 40 years or for the period of your employment plus 20 years, whichever is longer.

D. Your employer is required to release exposure and medical records to your physician upon your written request.

Appendix B

Substance Technical Guidelines for Acrylonitrile

1. Physical and Chemical Data

A. Substance identification

1. Synonyns: AN; VCN; Vinyl Cyanide; Propenenitrile; cyanoethylene; Acrylon; Carbacryl; Fumigrain; Ventox Synonyms:
2. Formula; CH2 = CHCN.
3. Molecular weight: 53.1

B. Physical data

1. Boiling point (760 mm Hg); 73.3^{o}C.
2. Specific gravity (water = 1): 0.81 (at 20^{o}C)
3. Vapor density (air = 1 at boiling pint of acrylonitrile: 1.83
4. Melting point: -83^{o}C.
5. Vapor pressure at 20^{o}C: 83 mm Hg.
6. Solubility in water. Percent by weight at 20^{o}C: 7.35.
7. Evaporation rate (Butyl Acetate = 1): 4.54.
8. Apperance and odor: Colorless to pale yellow liquid with a pungent odor at concentrations above the permissible exposure level. Any detectable odor of acrylonitrile may indicate overexposure.

2. Fire, explosion, and reactivity hazard data

A. Fire:

1. Flash point: –1^{o}C. (open cup).
2. Autoignition temperature: 481^{o}C).
3. Flammable limits in air, percent by volume: Lower 3; Upper 17.
4. Extinguishing media: Alcohol foam, carbon dioxide, dry chemical
5. Special fire-fighting procedure: Do not use a solid stream of water, since the stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.
6. Unusual fire and explosion hazards: Acrylonitrile is flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where acrylonitrile is handled, used or stored in a manner that could create a potential fire or explosion hazard. Acrylonitrile vapors are heavier than air and may travel along the ground and be ignited by open flames or sparks at locations remote from the site at which acrylonitrile is being handled.

7. Acrylonitirle is classified as a class 1B flammable liquid. For example, 7500 ppm, approximately one-fourth of the lower flammable limit, would be considered to pose a potential fire and explosion hazard.

8. For purposes of compliance with Section 2.7, acrylonitrile is classified as a Class B fire hazard.

9. For purposes of compliance with Section 7.0, locations classified as hazardous due to the presence of acrylonitrile shall be Class 1, Group D.

B. Reactivity

1. Conditions contributing to instability: Acrylonitrile will polymerize when hot, and the additional beat liberated by the polymerization may cause containers to explode. Pure AN may self-polymerize with a rapid build-up of pressure resulting in an explosion hazard. Inhibitors are added to the commercial product to prevent self-polymerization.

2. Incompatibilities: Contact with strong oxidizers (especially bromine) and strong bases may cause fires and explosions. Contact with copper, copper alloys, ammonia, and amines may start serious decomposition.

3. Hazardous decomposition products: Toxic gases and vapors (such as hydrogen cyanide, oxides of nitrogen, and carbon monoxide) may be released in a fire involving acrylonitrile and certain polymers made from acrylonitrile.

4. Special precautions: Liquid acrylonitrile will attack some forms of plastics, rubbers, and coatings. Acrylonitrile monomer should be checked at least weekly to determine inhibitor content.

3. Spill, Leak, and Disposal Procedures

A. If acrylonitrile is spilled or leaked, the following steps should be taken:

1. Remove all ignition sources.

2. The area should be evacuated at once and re-entered only after through ventilation and washed down with water.

3. If liquid acrylonitrile or polymer intermediate, collect for reclamation or absorb in paper, vermiculite, dry sand, earth, or similar material, or wash down with water into process sewer system.

B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until clean-up has been completed.

C. Waste disposal methods: Waste material shall be disposed of in a manner that is not hazardous to employers or to the general population. Spills of acrylonitrile and flushing of such spills shall be channeled for appropriate treatment or collection for disposal. Containers of AN wastes shall be appropriately labeled. In selecting the method of waste disposal, regulations should be consulted.

4. Monitoring and Measurement Procedures

A. Exposure above the permissible exposure limit:

1. Eight-hour exposure evaluation: Measurements taken for the purpose of determining employee exposure under this section ate best taken so that the average eight-hour exposure may be determined from a single 8-hour exposure may be determined form a single 8-hour samples. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

2. Ceiling evaluation: Measurements taken for the purpose of determining employee exposure under this section must be taken during periods of maximum expected airborne concentrations of acrylonitrile in the employee's breathing zone. A minimum of 3 measurements should be taken on one work shift. The average of all measurement taken is an estimate of the employee's ceiling exposure.

3. Monitoring techniques: The sampling and analysis under this section may be performed by collecting the acrylonitrile vapor on charcoal adsorption tubes or other composition adsorption tubes, with subsequent chemical analysis. Sampling and analysis may also be performed by instruments such as real-time continuous monitoring systems, portable direct-reading instruments, or passive dosimeters.

4. The employer has the obligation of selecting a monitoring method which meets the accuracy and precision requirements of the standard under his unique field conditions. The standard requires that methods of monitoring must be accurate, to a 95-percent confidence level, to ± 35 percent for concentrations below 2 ppm. In addition to the methods described in Appendix D, there are numerous other methods available for monitoring for AN in the workplace.

B. Since many of the duties relating to employee exposure are dependent on the results of monitoring and measuring procedures, employers shall assure that the evaluation of employee exposures is performed by a competent industrial hygienist or other technically qualified person.

5. Protective Clothing

Employees shall be provided with, and required with, and required to wear appropriate protective clothing to prevent any possibility of skin contact with liquid AN. Because acrylonitrile is absorbed through the skin, it is important to prevent skin contact with the liquid. Protective clothing shall include impermeable coveralls or similar full-body work clothing , gloves, head-coverings, and work-shoes or shoe coverings, as appropriate to protect areas of the body which may come in contact with liquid Acrylonitile.

Employers should ascertain that the protective garments are impermeable to acrylonitrile. Non-impermeable clothing and shoes should not be allowed to become contaminated with acrylonitrile. If permeable clothing does become contaminated, it should be promptly removed and not worn again until completely free of the materials. If leather footwear or other leather garments become wet from acrylonitile, they should be replaced and not worn again, due to the ability of leather to absorb acrylonitrile and hold it against the skin. Since there is no pain associated with the blistering, it is essential that the employee be informed of this hazard so that he or she can be protected.

Any protective clothing which has developed leaks or is otherwise found to be defective should be repaired or replaced. Clean protective clothing shall be provided to the employee, and whenever the clothing becomes wet with liquid AN. Employees are also required to wear splash-proof safety goggles where there is any possibility of acrylonitrile containing the eyes.

6. Housekeeping and Hygiene Facilities

For purposes of complying with Section 2.6, the following items should be emphasized:

A. The workplace should be kept clean, orderly, and in a sanitary conditions;

B. Dry sweeping and the use of compressed air is unsafe for the cleaning of floors and other surfaces where liquid Acrylonitrile may be found;

C. Adequate washing facilities with hot and cold water should be provided, and maintained in a sanitary condition. Suitable cleansing agents should also be provided to assure the effective removal of acrylonitrile from the skin;

D. Change or dressing rooms with individual clothes-storage facilities should be provided to prevent the contamination of street clothes with acrylonitrile. Because of the hazardous nature of acrylonitrile, contaminated protective clothing should be stored in closed containers for cleaning or disposal.

7. Miscellaneous Precautions

A. Store acrylonitrile in tightly-closed containers in a cool, well-ventilated area, and take the necessary precautions to avoid an explosion hazard.

B. High exposure to acrylonitrile can occur when transferring the liquid for one container to another.

C. Non-sparking tools must be used to open and close metal acrylonitrile containers. There containers must be effectively grounded and bonded prior to pouring.

D. Never store uninhibited acrylonitrile

E. Acrylonitrile vapors are not inhibited. They may form polymers and clog vents of storage tanks.

F Use air-supplied suits or other impervious coverings may be necessary to prevent skin contact and provide respiratory protection from with acrylonitriel where the concentration of acrylonitrile is unknown or is above the ceiling limit. Air-supplied suits should be selected, used, and maintained under the immediate supervision of persons knowledgeable in the limitations and potential life-endangering characteristics of supplied-air suits.

G. Employers shall advise employees of all areas and operations where exposure to acrylonitrile could occur.

8. Common Operations

Common operations in which exposure to acrylonitrile is likely to occur, include the following: Manufacture of the acrylonitrile monomer; synthesis of acrylic fibers, Acrylonitrile-Butadiene-Styrene and Styrene-Acrylonitrile plastics, resins, nitrile rubber, surface coatings, specialty chemicals, sue as a chemical intermediate, use as a fumigant and in the cyanoethylation of cotton.

Appendix C

Medical Surveillance Guidelines for Acrylonitrile

1. Route of Entry

Inhalation; skin and absorption; ingestion

2. Toxicology

Acrylonitrile vapor is an asphyxiant due to its inhibitory action on metabolic enzyme systems,. Animals exposed to 75 or 100 ppm for 7 hours have shown signs of anoxia; in some animals which died at the higher level, cyanomethemoglobin was found in the blood. Two human fatalities from accidental poisoning have been reported; one was caused by inhalation of an unknown concentration of the vapor; and the other was though to be caused by skin absorption or inhalation. Most cases of intoxication form industrial exposure have been mild, with rapid onset of eye irritation, headache, sneezing, and nausea. Weakness, lightheadedness, and vomiting may also occur. Exposure to high concentrations, may produce profound weakness, asphyxia, and death. The vapor is a severe eye irritant. Prolonged skin contact with the liquid may result in absorption with systemic effects, and in the formulation of large blisters after a latent period of several hours. Although there is usually little or no pain or inflammation, the affected skin resembles a second-degree thermal burn. Solutions spilled on exposed skin, or on areas covered only by a light layer of clothing, evaporate rapidly, leaving no irritation, or, at the most, mild transient redness. Repeated spills on exposed skin may result in dermititus due to solvent effects.

Results after 1 year of a planned 2 year animal study on the effects of exposure to acrylonitrile have indicated that rats ingesting as little as 35 ppm in their drinking water develop turmors of the central nervous system. The interim results of this study have been supported by a similar study being conducted by the same laboratory, involving exposure of rates by inhalation of acrylonitrile vapor, which has shown similar types of tumors in animals exposed to 80 ppm

In addition, the preliminary results of an epidemiological study in an acrylic fiber plant indicate a statistically significant increase in the incidence of colon and lung cancer among employees exposed to acrylonitrile.

3. Sings and Symptoms of Acute Overexposure

Asphyxia and death can occur from exposure to high concentrations of acrylonitrile. Symptoms of overexposrue include eye irritation, headache, sneezing, nausea and vomiting, weakness, and light-headedness. Prolonged skin contact can cause blisters on the skin, with the appearance of a second degree thermal burn, but with little or no pain. Repeated skin contact may produce scaling dermatitis.

4. treatment of Acute Overexposure

Remove employee from exposure. Immediately flush eyes with water and wash skin with soap or mild detergent and water. If acrylonitrile has been swallowed and person is conscious, induce vomiting, Give artificial resuscitation if indicated. More severe cases, such as those associated with loss of consciousness, may be treated by the intravenous

administration of sodium nitrite, followed by sodium thiosulfate, although this is not as effective for acrylonitrile poisoning as for inorganic cyanide poisoning.

5. Surveillance and Preventive Consideration

A. As noted above, exposure to acrylonitrile has been linked to increase incidence of cancers of the colon and lung. In addition, the animal testing of acrylonitrile has resulted in the development of cancers of the central nervous system in rats exposed by either inhalation or ingestion. The physician should be aware of the findings of these studies in evaluating the health of employees exposed to acrylonitrile.

Most reported acute effects of occupational exposure to acrylonitrile are due to its ability to cause tissue anoxia and asphyxia. The effects are similar to those caused by hydrogen cyanide. Liquid acrylonitrile can be absorbed through the skin upon prolonged contact. The liquid readily penetrates leather, and will produce burns of the feet if footwear contaminated with acrylonitrile is not removed.

It is important for the physician to become familiar with the operating conditions in which exposure to acrylonitrile may occur. Those employees with skin disease may not tolerate the wearing of whatever protective clothing may be necessary to protect them from exposure. In addition, those with chromic respiratory disease may not tolerate the wearing of negative-pressure respirators.

B. surveillance and Screening. Medical histories and laboratory examinations are required for each employee subject to exposure to acrylonitrile above the action level. The employer must screen employees for history of certain medical conditions which might place the employees at increased risk from exposure.

1. Central nervous systems system dysfunction. Acute effects of exposure to acrylonitrile generally involve the central nervous system. Symptoms of acrylonitrile exposure include headache, nausea, dizziness, and general weakness. The animal studies cited above suggest possible carcinogenic effects of acrylonitrile on the central nervous system, since rats exposed by either inhalation or ingestion have developed similar central nervous system tumors.

2. Respiratory disease. Study data indicate an increased risk of cancer among employees exposed t acrylonitrile.

3. Gastrointestinal disease. Study data indicate an increased risk of cancer of the colon among employees exposed to acrylonitrile. In addition, the animal studies show possible tumorogenic effects on the stomachs of the rates in the ingestion study.

4. Skin disease. Acrylonitrile can cause skin burns when prolonged skin contact with the liquid occurs. In addition, repeated skin contact with the liquid can cause dermatitis.

5. General. The purpose of the medical procedures outlined in the standards is to establish a baseline for future health monitoring. Persons unusually susceptible to the effects of anoxia or those with anemia would be expected to be at increases risk. In addition to emphasis on the central nervous

system, respiratory and gastrointentinal systems, the cardiovascular system, liver and kidney function should also be stressed.

7 1,2-dibromo-3-chloropropane

7.1 Definitions

— Authorized person. Any person required by his duties to be present in regulated areas and authorized to do so by his employer. "Authorized person" also includes any person entering such areas as a designated representative of employees exercising an opportunity to observe employee exposure monitoring.

— DBCP. 1,2-dibromo-3-chloropropane, and all forms of DBCP.

— Emergency. Any occurrence such as, but not limited to equipment failure, rupture of containers, or failure of control equipment which may, or does, result in an unexpected release of DBCP.

7.2 Scope and application

This paragraph applies to occupational exposure to 1,2-dibromo-3-chloropropane (DBCP).

This paragraph does not apply to:

Exposure to DBCP which results solely form the application and use of DBCP as a pesticide; or

The storage, transportation, distribution or sale of DBCP in intact containers sealed in such a manner as to prevent exposure to DBCP vapors to liquid, except for the requirements of subparagraph 7.9, 7.14 and 7.15.

7.3 Permissible exposure limit

7.3.1 The employer shall assure that no employee is exposed to an airborne concentration of DBCP in excess of 1 part DBCP per DBCP per billion parts of air as an 8-hour time weighted average.

7.3.2 The employer shall assure that no employee is exposed to eye or skin contact with DBCP.

7.4 Notification of use. Within 10 days following the introduction of DBCP into the workplace, every employer who has a workplace where DBCP is present, shall report the following information to the concerned authorities for each such workplace.

7.4.1 The address and location of the workplace.

7.4.2 A brief description of each process or operation which may results in employee exposure to DBCP.

7.4.3 The number of employees engaged in each process or operation who may be exposed to DBCP and an estimate of the frequency and degree of exposure that occurs; and

7.4.4 A brief description of the employer's safety and health program as it relates to limitation of employee exposure to DBCP.

7.5 Regulated areas

7.5.1 The employer shall establish, within each place of employment, regulated areas wherever DBCP concentration are in excess of the permissible exposure limit.

7.5.2 The employer shall access to regulated areas to authorized persons.

7.6 Exposure Monitoring

7.6.1 Determinations of airborne exposure levels shall be made from air samples that are representative of each employee's exposure to DBCP over an 8-hur period.

7.6.2 For the purpose of this subparagraph, employee exposure is that exposure which would occur if the employee were not using a respirator.

7.6.3 Each employer who has a place of employment in which DBCP is present, shall monitor each workplace and work operation to accurately determine the airborne concentrations of DBCP to which employees may be exposed.

7.6.4 If the monitoring reveals employees exposure to be below the permissible exposure limit, the employer shall repeat these measurement at least quarterly.

7.6.5 If the monitoring reveals employee exposures to be in excess of the permissible exposure limit, the employer shall repeat these measurement for each such employee at least monthly. The employer shall continue monthly monitoring until at least two consecutive measurements, taken at least 7 days apart, are below the permissible exposure limit. Thereafter the employer shall monitor at least quarterly.

7.6.6 Whenever there has been a production, process, control, or personnel change which may result in any new or additional exposure to DBCP, or whenever the employer has any reason to suspect new or additional exposure to DBCP, the employer shall monitor the employees potentially affected by such change for the purpose of re-determining their exposure.

7.6.7 Within 5 working days after the receipt of monitoring results, the employer shall notify each employee in writing of the measurements which represent the employee's exposure.

7.6.8 Whenever the results indicate that employee exposure exceeds the permissible exposure limit, the employer shall include in the written notice a statement that the permissible exposure limit was exceeded and a description of the corrective action being taken to reduce exposure to or below the permissible exposure limit.

7.6.9 The employer shall use a method of measurement which has an accuracy, to a confidence level of 95 percent, of not less than ± 25 percent for concentrations of DBCP at or above the permissible exposure limit.

7.7 Method of compliance

7.7.1 The employer shall institute engineering and work practice controls to reduce and maintain employee exposure to DBCP at or below the permissible exposure limit, except to the extent that the employer establishes that such controls are not feasible. Where feasible engineering and work practice controls are not sufficient to reduce employee exposure to within the permissible exposure limit, the employer shall nonetheless use them to reduce exposures to the lowest level

achievable by those controls, and shall supplement them by use of respiratory protection.

7.7.2 The employer shall establish and implement a written program to reduce employee exposure DBCP to or below the permissible exposure limit solely by means of engineering and work practice controls as required by subparagraph 7.7.1.

7.7.3 The written program shall include a detailed schedule for development and implementation of the engineering and work practice controls. These plans shall be revised at least every 6 months to reflect the current status of the program.

7.7.4 Written plans for these compliance programs shall be submitted upon request to the concerned authorities, and shall be available at the worksite for examination and copying by the concerned authorities, and any affected employee or designated representative of employees.

7.7.5 The employer shall institute and maintain at least the controls described in his most recent written compliance program.

7.8 Respirators

7.8.1 Where respiratory protection is required under this paragraph, the employer shall select, provide and assure the proper use of respirators. Respirators shall be sued in the following circumstances;

7.8.1.1 During the period necessary to install or implement feasible engineering and work practice controls; or

7.8.1.2 During maintenance and repair activities in which engineering and work practice controls are not feasible; or

7.8.1.3 In work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the permissible exposure limit: or

7.8.1.4 In emergencies.

7.8.2 Where respirators are required, the employer shall select and provide at no cost to the employee, the appropriate approved respirator from table below and shall assure that the employee uses the respirator provided

7.8.3 The employer shall institute a respiratory protection program in accordance with Section 5.3.

7.8.4 Employees who wear respirators shall be allowed to wash their faces and respirator facepieces as needed to prevent potential skin irritation associated with respirator use.

7.9 Emergency situations

7.9.1 A written plan for emergency situations shall be developed for each workplace in which DBCP is present.

Table -6

Respiratory protection of DBCP

Airborne concentration of DBCP or conditions of use	Respirator type
a) Less than or equal to 10 ppb	(1) Any air-supplied respirator; or (2) Any self-contained breathing apparatus.
b) Less than or equal to 50 ppb	(1) Any air-supplied respirator with full facepiece, helmet, or hood; or (2) Any self-contained breathing apparatus with full facepiece.
c) Less than or equal to 1000 ppb	A air-supplied respirator operated in pressure-demand or other positive pressure or continuous flow mode.
d) Less than or equal to 2000 ppb	A air-supplied respirator with full facepiece operated in pressure-demand or other positive pressure mode, or with full facepiece, helmet, or hood operated in continues flow mode.
e) Greater than 2000 ppb or entry and escape from unknown concentrations	(1) A combination respirator which includes a air-supplied respirator with full facepiece operated in pressure-demand or other positive pressure or continuous flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or positive pressure mode; or (2) A self-contained breathing apparatus with full facepiece operated in pressure demand or other positive pressure mode.
f) Firefighting	A self-contained breathing apparatus with full facepiece operated in pressure demand or other positive pressure mode.

7.9.2 Appropriate proteins of the plan shall be implemented in the event of an emergency.

7.9.3 Employees engaged in correcting emergency conditions shall be equipped as required in subparagraphs 7.8 and 7.10 until the emergency is abated.

7.9.4 Employees not engaged in correcting the emergency shall be removed and restricted from the area and normal operations in the affected area shall not be resumed until the emergency is abated..

7.9.5 Where there is a possibility of employee exposure to DBCP due to the occurrence of an emergency, a general alarm shall be installed and maintained to promptly alert employees of such occurrences.

7.9.6 For any employee exposed to DBCP in as emergency situations, the employer shall provide medical surveillance in accordance with subparagraph 7.13.6.

7.9.7 Following an emergency, the employer shall conduct monitoring which complies with subparagraph 7.6.

7.9.8 In workplaces not normally subject to periodic monitoring, the employer may terminate monitoring when two consecutive measurements indicate exposures below the permissible exposure limit.

7.10 Protective clothing and equipment

7.10.1 Where there is any possibility of eye or dermal contact with liquid or solid DBCP, the employer shall provide, at no cost to the employee, and assure that the employee wears impermeable protective clothing and equipment to protect the area of the body which may come in contact with DBCP. Eye and face protection shall meet the requirements of subparagraph 7.12.1.

7.10.2 The employer shall assure that employees remove DBCP contaminated work clothing only in change rooms provided in accordance with subparagraph 7.12.1

7.10.3 The employer shall assure that employees promptly remove any protective clothing and equipment which becomes contaminated with DBCP-containing liquids and solids. This clothing shall not be reworn until the DBCP has been removed form the clothing or equipment.

10.7.4 The employer shall assure that no employee takes DBCP contaminated protective devices and work clothing out of the change room, except those employees authorized to do so for the purpose of laundering, maintenance, of disposal.

7.10.5 DBCP-contaminated protective devices and work clothing shall be placed and stored in closed containers which prevent dispersion of the DBCP outside the container.

7.10.6 Containers of DBCP contaminated protective devices or work clothing which are to be taken out of change rooms or the workplace for cleaning, maintenance or disposal, shall bear labels in accordance with subparagraph 7.15.3.

7.10.7 The employer shall clean, launder, repair, or replace protective clothing and equipment required by this subparagraph to maintain their effectiveness. The employer shall provide clean protective clothing and equipment at least daily to each affected employee.

7.10.8 The employer shall inform any person who launders or cleans DBCP-contaminated protective clothing or equipment of the potentially harmful effects of exposure to DBCP.

7.10.9 The employer shall prohibit the removal of DBCP from protective clothing and equipment by blowing or shaking.

7.11 Housekeeping

7.11.1 All workplace surfaces shall be maintained free of visible accumulations of DBCP.

7.11.2 Dry sweeping and the use of compressed air for the cleaning of floors and others surfaces is prohibited where DBCP dusts or liquids are present.

7.11.3 Where vacuuming methods are selected to clean floors and other surfaces, either portable units or a permanent system may be used. If a portable unit is selected, the exhaust shall be attached to the general workplace exhaust ventilation system or collected within the vacuum unit, equipped with high efficiency filers or other appropriate means of contaminant removal, so that DBCP is not reintroduced into the workplace air; and portable vacuum units used to collect DBCP may not be sued for other cleaning purposes and shall be labeled as prescribed by subparagraph 7.15.3.

7.11.4 Cleaning of floors and other surfaces contaminated with DBCP-containing dusts shall not be performed by washing down with a hose, unless a fine spray has first been laid down.

7.11.5 Where DBCP is present in a liquid form, or as a resultant vapor, all containers or vessels containing DBCP shall be enclosed to the maximum extent feasible and tightly covered when not in use.

7.11.6 DBCP waste scrap, debris, containers or equipment, shall be disposed of in sealed bags or other closed containers which prevent dispersion of DBCP outside the container.

7.12 Hygiene facilities and practices

7.12.1 The employer shall provide clean change rooms equipped with storage facilities for street clothes and separate storage facilities for protective clothing and equipment whenever employees are required to wear protective clothing and equipment in accordance with subparagraphs 7.8 and 7.10.

7.12.2 The employer shall assure that employees working in the regulated area shower at the end of the work shift.

7.12.3 The employer shall assure that employers whose skin becomes contaminated with DBCP containing liquids or solids immediately wash or shower to remove any DBCP form the skin.

7.12.4 The employer shall provide shower facilities in accordance with section 2.6.

7.12.5 The employer shall provide lunchroom facilities which have a temperature controlled, positive pressure, filtered air supply, and which are readily accessible to employees working in regulated areas.

7.12.6 The employer shall assure that employees working in the regulated area remove protective clothing and wash their hands and face prior to eating.

7.12.7 The employer shall provide a sufficient number or lavatory facilities which comply with Section 2.6.

7.12.8 The employer shall assure that, in regulated areas, food or beverages are not present or consumed, smoking products and implements are not present or use, and cosmetics are not present or applied.

7.13 Medical surveillance

7.13.1 The employer shall make available a medical surveillance program for employees who work in regulated areas and employees who are subjected to DBCP exposure in any emergency situation.

7.13.2 All medical examinations and procedures shall be performed by or under the supervision of a licensed physician, and shall be provided without cost to the employee.

7.13.3 At the time of initial assignment, and annually thereafter, the employer shall provide a medical examination for employees who work in regulated areas, which includes at least the following:

7.13.4 A medical and occupational history including reproductive history.

7.13.5 A physical examination including examination of the genito-urinary tract, testicle size and body habitués, including a determination of sperm count.

7.13.6 A serum specimen shall be obtained and the following determinations made by radioimmunoassay techniques using:

Serum follicle stimulating hormone (FSH);

Serum luteinizing hormone (LH); and

Serum total estrogen (females).

7.13.7 Any other tests deemed appropriate by the examining physician.

7.13.8 If the employee for any reason develops signs or symptoms commonly associated with exposure to DBCP, the employer shall provide the employee with a medical examination which shall include those elements considered appropriate by the examining physician:

7.13.9 The employer shall provide the following information to the examining physician:

(a) A copy of this regulation and its appendices;

(b) A description of the affected employee's duties as they relate to the employee's exposure;

(c) The level of DBCP to which the employee is exposed; and

(d) A description of any personal protective equipment used or to be used.

7.13.10 For each examination the employer shall obtain and provide the employee with a written opinion from the examining physician which shall include;

— The results of the medical tests performed;

— The physician's opinion as to whether the employee has any detected medical condition which would place the employee at an increased risk of material impairment of health from exposure to DBCP; and

— Any recommended limitations upon the employee's exposure to DBCP or upon the use of protective clothing and equipment such as respirators.

7.13.11 The employer shall instruct the physician not to reveal in the written opinion specific findings or diagnoses unrelated to occupational exposure.

7.13.12 Emergency situations. If the employee is exposed to DBCP in an emergency situation, the employer shall provide the employee with a sperm count test as soon as practicable, or, if the employee has been vasectionized or is unable to produce a

semen specimen, the hormone tests contained in subparagraph 4.7.5.13.6. The employer shall provide these same tests 3 months later.

7.14 Employee information and Training

7.14.1 The employer shall institute a training program for all employees who may be exposed to DBCP and shall assure their participation in such training program.

7.14.2 The employer shall assure that each employee is informed of the following:

— The information contained in Appendix A:

— The quantity, location, manner of use, release or storage of DBCP and the specific nature of operations which could result in exposure to DBCP as well as any necessary protective steps;

— The purpose, proper use, and limitations of respirators;

The purpose and description of the medical surveillance program required by subparagraph 7.13; and

— A review of this standard, including appendices.

7.14.3 The employer shall make a copy of this standard and its appendices readily available to all affected employees.

7.14.4 The employer shall provide, upon request, all materials relating to the employee information and training program to the concerned authorities.

7.15 Signs and labels

7.15.1 The employer may use labels or signs required by other statutes, regulations, or ordinances in addition to or in combination with, signs and labels required by this subparagraph.

7.15.2 The employer shall assure that no statement appears on or near any sign or label required by this subparagraph which contradicts or detracts from the required sign or label.

7.15.3 The employer shall post signs to clearly indicate all regulated areas. These signs shall bear the legend;

DANGER
1,2-dibromo-3chloropropane
(Insert appropriate trade or common names)
CANCER HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATOR REQUIRED

7.15.4 The employer shall assure that precautionary labels are affixed to all containers of DBCP and of products containing DBCP in the workplace, and that the labels remain affixed when the DBCP or products containing DBCP are sold, distributed, or otherwise leave the employer's workplace.

7.15.5 The employer shall assure that the precautionary labels required by this subparagraph are readily visible and legible. The labels shall bear the following legend;

DANGER
1,2-dibromo-3chloropropane
CANCER HAZARD

7.16 Record keeping

7.16.1 The employer shall establish and maintain an accurate record of all monitoring required by subparagraph 7.6.

7.16.2 The dates, number, duration and results of each of these samples taken, including a description of the sampling procedure used to determine representative employer exposure;

— A description of the sampling and analytical methods used;

— Type of respiratory protective devices worn, if any; and

— Name and job classification of the employee monitored and of all other employees whose exposure the measurement is intended to represent.

7.16.3 The employer shall maintain this record for at least 40 years or the duration of employment plus 20 years, whichever is longer.

7.16.4 The employer shall establish and maintain an accurate record for each employee subject to medical surveillance required by subparagraph 7.13.

7.16.5 This record shall include;

— The name of the employee;

— A copy of the physician's written opinion;

— Any employee medical complaints related to exposure to DBCP;

— A copy of the information provided the physician as required by subparagraphs 7.13.9 (b) through 7.13.9 (d); and

— A copy of the employee's medical and work history.

7.16.6 The employer shall maintain this record for a least 40 years or the duration of employment plus 20 years, whichever is longer.

7.16.7 The employer shall assure that all records required to be maintained by this subparagraph be made available upon request to the concerned authorities for examination and copying.

7.16.8 The employer shall assure that all employee exposure monitoring records be made available for examination and copying to affected employee or their designated representative.

7.16.9 The employer shall assure that former employees and former employee's designated representative have access to such record as will indicate the former employee's own exposure to DBCP.

7.16.10 The employer shall assure that employee medical records be made available, upon request, for examination and copying to the employee or former employee and to a physician or other individual designated by the affected employee or former employee.

7.16.11 If the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by subparagraph 7.16 for the prescribed period.

7.16.12 If the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall transmit these records to the concerned authorities.

7.16.13 At the expiration of the retention period for the records required to be maintained under subparagraph 7.16, the employer shall transmit these records to the concerned authorities.

7.17 Observation of monitoring

7.17.1 The employer shall provide affected employees, or their designated representatives, with as opportunity to observe any monitoring of employee exposure to DBCP.

7.17.2 Whenever observation of the measuring or monitoring of employee exposure to DBCP requires entry into an area where the use of protective clothing or equipment is required, the employer shall provide the observer with personal protective clothing or equipment required to be worn by employees working in the area, assure the use of such clothing and equipment, and require the observer to comply with all other applicable safety and health procedures.

7.17.3 Without interfering with the monitoring or measurement, observers shall be entitled to:

— Receive an explanation of the measurement procedures;

— Observe all steps related to the measurement of airborne concentrations of DBCP performed at the place of exposure; and

— Record the results obtained.

7.18 Appendices. The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract form any existing obligation.

Appendix A

Substance Safety Data Sheet for DBCP

1. Substance Identification

A. Synonyms and trades names: DBCP; Dibromochloropropane; Fumazone (Dow Chemical Company TM); Nemafume; Nemagon (Shell Chemical Co. TM); Nemaset; BBC 12; and OS 1879.

B. Permissible exposure:

1. Airborne, 1 part DBCP vapor per billon parts of air: time-weighed average (TWA) for an 8-hour workday.

2. Dermal. Eye contact and skin contact with DBCP are prohibited.

C. Apparatus and odor: Technical grade DBCP is a dense yellow or amber liquid with a pungent odor. It may also appear in granular form, or blended in varying concentrations with other liquids.

D. Uses: DBCP is used to control nematodes, very small worm-like plant parasites, on crops including cotton soybeans, fruits, nuts, vegetables and ornamentals.

2. Health Hazard Data

A. Routes of entry: Employees may be exposed:

1. Through inhalation (breathing);

2. Through ingestion (swallowing);

3. Skin contact; and

4. Eye contact.

B. Effects of exposure:

1. Acute exposure. DBCP may cause drowsiness, irritation of the eyes, nose, throat and skin, nausea and vomiting, in addition, overexposure may cause damage to the lungs, liver or kidneys.

2. Chronic exposure. Prolonged or repeated exposure to DBCP has been shown to cause sterility in humans. It also has been shown to produce cancer and sterility in laboratory animal sand has been determined to constitute an increased risk of cancer in man.

3. Reporting signs and symptoms. If you develop any of the above signs or symptoms that you think are caused by exposure to DBCP, you should inform your employer.

3. Emergency first aid procedures

A. Eye exposure. If DBCP liquid or dust containing DBCP gets into your eyes, wash your eyes immediately with large amounts or water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with DBCP.

B. Skin exposure. If DBCP liquids or dusts containing DBCP get on your skin, immediately wash using soap or mild detergent and water. If DBCP liquids or dusts containing DBCP penetrate through your clothing, remove the clothing immediately wash. If irritation is present after washing get medical attention.

C. Breathing. If you or any person breathe in large amounts of DBCP, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Do not use mouth-to-mouth. Keep the affected person warm and at rest. Get medical attention as soon as possible.

D. Swallowing. When DBCP has been swallowed and the person is conscious, give the person large amounts of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.

E. Rescue. Notify someone. Put into effect the established emergency rescue procedures. Know the locations of the emergency rescue equipment before the need arises.

4. Respirators and Protective Clothing

A. Respirators. You may be required to wear a respirator in emergencies and while your employer is in the process of reducing DBCPA exposures through engineering controls. If respirators are worn, they must have an approved label. For effective protection, a respirator must fit your face and head snugly. The respirator should not be loosened or removed in work situations where its use is required. DBCP does not have a detectable odor except at 1000 times or more above the permissible exposure limit. If you can smell DBCP while searing a respirator, the respirator is not working correctly; go immediately to fresh air. If you experience difficulty breathing while wearing a respirator, tell your employer.

B. Protective clothing. When working with DBCP you must wear for your protection impermeable work clothing provided by your employer. (Standard rubber and neoprene protective clothing do not offer adequate protection).

DBCP must never be allowed to remain on the skin. Clothing and shoes must not be allowed to become contaminated with DBCP, and if they do, they must be promptly removed and not worn again until completely free of DBCP, Turn in impermeable clothing that has developed leaks for repair or replacement.

C. Eye protection. You must wear splash-proof safety goggles where there is any possibility of DBCP liquid or dust contacting your eyes.

5. Precautions for Safe Use, Handling, and Storage

A. DBCP must be stored in tightly closed containers in a cool, well-ventilated area.

B. If your work clothing may have become contaminated with DBCP, or liquid or dusts containing DBCP, or liquids or dusts containing DBCP, you must change into uncontaminated clothing before leaving the work premises.

C. You must promptly remove any protective clothing that becomes contaminated with DBCP. This clothing mist not be reworn until the DBCP is removed form the clothing.

D. If your skin becomes contaminated with DBCP, you mist immediately and thoroughly wash or shower with soap or mild detergent and water to remove any DBCP from your skin.

E. You must not keep food, beverages, cosmetics, or smoking material, nor eat or smoke, in regulated areas.

F. If you work in a regulated area, you must wash your hands thoroughly with soap or milk detergent and water, before eating, smoking or using toilet facilities.

G. If you work in a regulated area, you must remove any protective equipment or clothing before leaving the regulated area.

H. Ask your supervisor where DBCP is used in your work area and for any additional safety and health rules.

6. Access to information

A. Each year, your employer is required to inform you of the information contained in this Substance safety data sheet for DBCP. In addition, your employer must instruct you in the safe use of DBCP, emergency procedures, and the correct use of protective equipment.

B. Your employer is required to determine whether your are being exposed to DBCP. You or your representative have the right to observe employee exposure measurements and to record the result obtained. Your employer is required to inform your of your exposure. If your employer determines that you are being overexposed, he is required to inform you of the actions which are being taken to reduce your exposure.

C. Your employer is required to keep records of your exposure and medical examinations. Your employer is required to keep exposure and medical data for at least 40 years or the duration of your employment plus 20 years, whichever is longer.

D. Your employer is required to release exposure and medical records to you, your physician, or other individual designated by you upon your written request.

Appendix B

Substance Technical Guidelines for DBCP

1. Physical and Chemical Data

A. Substance identification

1. Synonyms: 1,2-dibromo-3-chloropropane; DBCP, Fumazone; Nemafume; Nemagon; Nemaset; BBC 12; OS 1379, DBCP is also included in agricultural pesticides and fumigants which include the phrase "Nema ……" in their name.
2. Chemical symbol: $C_3H_5Br_2Cl$.
3. Molecular weight: 236.

B. Physical data

1. Boiling point (760 mm Hg): 195^{o}C.
2. Specific Gravity (water = 1): 2.093
3. Vapor density (air = 1 at boiling point of DBCP); Data not available.
4. Melting point: 6^{o}C.
5. Vapor pressure at 20^{o}C: 0.3 mm Hg.
6. Solubility in water: 1000 ppm.
7. Evaporation rate (Butyl Acetate= 1): Very much less than 1.
8. Appearance and odor: Dense yellow or amber liquid with a pungent odor at high concentrations. Any detectable odor of DBCP indicates overexposure

2. Fire explosion and reactivity hazard data

A. Fire

1. Flash point: 77^{o}C.
2. Auto-ignition temperature: Data not available
3. Flammable limits in air, percent by volume: Data not available:
4. Extinguishing media: Carbon dioxide, dry chemical.
5. Special fire-fighting procedures: Do not use a solid stream of water since a stream will scatter and spread the fire. Use water spray to cool containers exposed a fire.
6. Unusual fire and explosion hazards: None known.
7. For purposes of complying with the requirements of section 4.2, liquid DBCP is classified as a class 3A combustible liquid.
8. For the purpose of complying with section 7.0, the classification of hazardous locations for DBCP shall be class 1, Group D.

9. For the purpose of compliance with Section 2.7, DBCP is classified as Class B fire hazard.

10. For the purpose of compliance with paragraph 7.2.27, locations classified as hazardous locations due to the presence of DBCP shall be Class 1, Group D.

11. Sources of ignition are prohibited where DBCP presents a fire or explosion hazard.

B. Reactivity

1. Conditions contributing to instability: None known.
2. Incompatibilities: Reacts with chemically active metals, such as aluminum, magnesium and tin alloys.
3. Hazardous Decomposition products: Toxic gases and vapors (such as HBr, HCl and CO) may be released in a fire involving DBCP.
4. Special precautions. DBCP will attach some rubber materials and coatings.

3. Spill, Leak And Disposal Procedures

A. If DBCP is spilled or leaked, the following steps should be taken:

1. The area should be evacuated at once and re-entered only after through ventilation.
2. ventilate area of spill or leak.
3. If in liquid form, collect for reclamation or absorb in paper, vermiculite, dry sand, earth or similar material.
4. If in liquid form, collect spilled material in the most convenient and safe manner for reclamation or for disposal .

B. Persons not wearing protective equipment must be restricted form areas of spills or leaks until cleanup has been completed.

C. Waste Disposal Method

1. For small quantities of liquid DBCP, absorb on paper towels, remove to a safe place (such as a fume hood) and burn the paper. Large quantities can be reclaimed or collected an atomized in a suitable combustion chamber equipped with an appropriate effluent gas-cleaning device. If liquid DBCP is absorbed in vermiculite, dry san, earth or similar material and placed in sealed containers it may be disposed of in a SAOS approved sanitary landfill.

2. If in solid form, for small quantities, place on paper towels, remove to a safe place (such as a fume hood) and burn. Large quantities may be reclaimed. However , if this is not practical, dissolve in a flammable solvent (such as alcohol) and atomize in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. DBCP in solid form may also be disposed in a GS approved sanitary landfill.

4. Monitoring and Measurement Procedures

A. Exposure above the permissible exposure limit

1. Eight hour exposure evaluation: Measurements taken for the purpose of determining employee exposure are best taken so that the average 8-hour exposure may be determined from a single 8-hour sample or 24-hour samples. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

2. Monitoring Techniques: The sampling and analysis may be performed by collecting the DBCP vapor on petroleum based charcoal absorption tubes with subsequent chemical analysis. The method of measurement chosen should determine the concentration of airborne DBCP at the permissible exposure limit to an accuracy of ± 25 percent. If charcoal tubes are used, a total volume of 10 liters should be collected at a flow rate of 50 cc/min. for each tube. Analyze the resultant samples as you would samples of halogenated solvent.

B. Since many of the duties relating to employee protection are dependent on the results of monitoring and measuring procedures, employers should assure that the evaluation of employee exposures is performed by a competent industrial hygienist or other technically qualified person.

5. Protective Clothing

Employee should be required to wear appropriate protective clothing to prevent any possibility of skin contact with DBCP. Because DBCP is absorbed through the skin, it is important to prevent skin contact with both liquid and solid forms of DBCP. Protective clothing should include impermeable coveralls or similar full bodywork clothing, gloves, head covering, and workshops or shoe covering. Standard rubber and neoprene gloves do not offer adequate protection and should not be relied upon to keep DBCP off the skin. DBCP should never be allowed to remain on the skin. Clothing and shoes should not be allowed to become contaminated with the materials, and if they do, they should be promptly removed and not worn again until completely free of the material. Any protective clothing which has developed leaks or is otherwise found to be defective should be repaired or replaced. Employees should also be required to wear splash-proof safety goggles where there is any possibility of DBCP contacting the eyes.

6. Housekeeping and Hygiene Facilities

1. The workplace must be kept clean, orderly and in a sanitary condition;

2. Dry sweeping and the use of compressed air is unsafe for the cleaning of floors and other surface where DBCP dust or liquids are found. To minimize the contamination of air with dust, vacuuming with either portable or permanent systems must be used. If a portable unit is selected, the exhaust must be attached to the general workplace exhaust ventilation system, or collected within the vacuum unit equipped with high efficiency filters or other appropriate means of contamination removal and not used for other purposes. Units used to collect DBCP must be labeled.

3. Adequate washing facilities with hot and cold water must be provided, and maintained in a sanitary condition. Suitable cleansing agents should also be provided to assure the effective removal of DBCP from the skin.

4. Change or dressing rooms with individual clothes storages facilities must be provided to prevent the contamination of street clothes with DBCP. Because of the hazardous nature of DBCP, contaminated protective clothing must be stored in closed containers for cleaning or disposal .

7. Miscellaneous Precautions

A. Store DBCP in tightly closed containers in a cool, well ventilated area.

B. Use of air-supplied suits or other impervious clothing (such as acid suits) may be necessary to prevent skin contact with DBCP. Air supplied suits should be selected, used, and maintained under the supervision of person knowledgeable in the limitations and potential life endangering characteristics of air supplied suits.

C. The use of air-conditioned suits may be necessary in warmer climates.

D. Advise employees of all areas and operations where exposure to DBCP could occur.

8. Common Operations

Common operations in which exposure to DBCP is likely to occur are: during its production; and during its formulation into pesticides and fumigants.